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CONTENTS.

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THE STARCH EQUIVALENTS OF FEEDING STUFFS.

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THE problem before most feeders of stock at the present time is how to make home-grown foods go as far as possible, and to decide which purchased foods are the best value at current prices. Much more attention is now paid to the composition of concentrated foods, and, thanks to the Fertilisers and Feeding Stuffs Act, there is very considerably less misrepresentation concerning the nature and quality of these materials than in the past. Most farmers scrutinise the analysis of a feeding stuff before embarking upon its purchase, and this fact, combined with experience in the use of foods of various kinds, has resulted in much improvement in the composition of rations and in the economy of feeding.

To apportion the supply of home-grown and purchased foods in such a way as to avoid, on the one hand, giving too little, and, on the other, too much, is a problem which is ever before the farmer. Information on the subject is contained in leaflets issued by the Board, particularly Nos. 74 and 79. A perusal of those two leaflets, which embody the results of much recent investigation, will enable anyone to gain a general view of the subject. There are still some points, however, which, although perhaps not yet accepted by all authorities, are nevertheless advances upon what has so far been accounted the limit of our knowledge. An attempt to bring some of

these matters to the notice of those who are necessarily interested in them will be made in this article.

Digestibility Coefficients of Foods.—When dealing with individual feeding stuffs it will first of all be a matter of general agreement that in the chemical analysis we have merely a statement of the amount of protein (albuminoids), fat, carbohydrates, &c., present in the particular sample which has been analysed. Often the analysis is limited to a statement of the percentages of protein and oil as required by the Fertilisers and Feeding Stuffs Act. It is generally well known that a chemical analysis is not an absolute measure of the worth of a feeding stuff. That part only of a food or ration which is actually digested by the animal can be of use to it, either for maintaining the body in a condition of equilibrium, whereby the necessary losses are made good, or for productive purposes, *i.e.*, for the formation of body tissue (flesh and fat), for the production of milk, or as a source of energy for the performance of work. Those foods which are rich in protein and oil or in soluble carbohydrates have a high digestibility coefficient; that is to say, the amounts of nutrients (protein, oil, carbohydrates, &c.), which are proved to be present by means of the chemical analysis are digestible to a large extent. If, for example, a linseed cake had an analysis showing 40 per cent. of crude protein, and 10 per cent. of oil, much the greater part of these nutrients would be digestible. Taking the average digestibility coefficients for the protein and oil in linseed cake to be 90 per cent., as it would be in the case of a good sample, we see that the animal would actually digest 36 per cent. of protein and 9 per cent. of oil. Equally high digestibility coefficients would be found in the case of most oil cakes, and in peas, beans, gluten meal, and feeding stuffs of animal origin, like meat or fish meal, milk, &c. In a similar way the soluble carbohydrates in such foods as mangolds, swedes, turnips, peas, beans, wheat, and maize have a high percentage digestibility, even up to 90—95 per cent.

We are forced therefore in estimating the value of any feeding stuff to consider only the digestible nutrients which it contains, and not simply the chemical analysis. Thanks

to much painstaking work, which has been carried out largely in Germany and elsewhere on the Continent, and also in the United States, we are furnished with the digestibility co-efficients of the nutrients in almost all feeding stuffs, and in most cases where tables of the chemical analysis of foods are given it is also indicated what amount can be regarded as digestible. Naturally the figures which are quoted refer to the feeding stuffs and animals actually concerned, but it is not likely that we should find very marked differences in the results if similar trials were made with British foods and stock. As up to the present practically no such information is available from home sources, the data supplied by others must be used. When therefore an average feeding stuff is being considered, the commonly accepted digestibility co-efficients must be used. Much valuable information in this connection is contained in a table compiled by Dr. Chas. Crowther, and published by the University of Leeds. The figures, both for the total and the digestible constituents, apply to good average feeding stuffs. The leaflets referred to above, as well as most text-books on the subject, contain similar tables.

Availability of Foods.—Another point to be considered in connection with a feeding stuff is its availability. From whatever food, even the most digestible that an animal eats, a certain deduction has to be made for that part of it, or rather, the energy of that part of it, which is used up in the animal itself, chiefly in the processes of mastication and digestion. No true comparison can be made between the digestible nutrients in one feeding stuff and those in another unless the foods themselves are similar with regard to the form in which the nutrients are present. To take the digestible materials in oat straw as determined by chemical analysis and by actual digestibility trials with animals and compare them directly with what is found when linseed cake is treated in an analogous manner would not give us reliable information regarding the comparative feeding value of the two foods in question. If instead of oat straw we compared wheat straw with linseed cake the comparison would be even less reliable, for the nutrients in wheat straw have to bear a greater deduction than is the case with oat straw. This is because

mastication and digestion of the wheat straw throws so much work upon the functions of the body that after deducting the amount of energy used up in making the nutrients into a form that can be assimilated, very little is left to be placed to the credit of the animal body. Mastication and digestion are, as it were, a first charge upon the digested food material, and when this has been met the balance can be used for other purposes by the organism.

Experiments which have been designed to throw light upon this subject, and which have been carried out with exemplary care, have shown that the digested nutrients (protein, fat, carbohydrates, &c.) in such a food as linseed cake can be regarded as capable of producing the effect which would be obtained if they had been fed in pure form. When a full-grown animal is chosen, as is generally done in experiments of this nature, it is possible to determine directly by increase in body weight what gain has been caused by the feeding of certain of these nutrients, for it is well known that such an animal utilises the excess of food which its gets beyond its maintenance requirements for the formation of fat; the body is not capable of increasing in flesh to any appreciable extent. When, on the other hand, the digestible nutrients in a coarse fodder are considered it has been shown that the theoretical quantity of fat is never formed. The reason for the difference in these two cases undoubtedly lies in the fact that a material easy of mastication and digestion, like linseed cake, does not require much expenditure of energy for these processes, and there is on that account a large amount of nutritive matter left over for the formation of fat, when the ration is a productive one, *i.e.*, when there is more food material than the animal requires for maintenance purposes. On the other hand, a coarse fodder, like straw, requires a larger expenditure of energy for the conversion of the feeding material into a state fit for assimilation, and so a correspondingly smaller balance is retained for the building up of body tissue (chiefly fat).

To avoid any misunderstanding, it may be explained that every animal requires a certain amount of food for maintenance; that is, for making good the losses which occur unceasingly in every animal body. The movements of the

body and its organs, respiration, &c., are continually using up energy, which is stored in the body as some component part of it. To repair this waste, food must be given, and if a sufficient quantity is fed to counterbalance the losses exactly, then the animal is said to be on a maintenance diet, and its body weight would neither increase nor decrease. Any food given beyond maintenance requirements is used for production purposes, the three chief ways of which are manifested either in the formation of body tissue (fat) or milk, or in the performance of mechanical work. A diet which contains more nutrient material than the animal requires for maintenance purposes is a production diet. We are indebted to Continental investigators, and particularly to Kellner, for our knowledge of the fact that the value of the digested nutrients depends upon the food in which they are contained. Experimental evidence has been amply furnished in support of this view, and the conclusions are now generally accepted.

Much of the difference in the availability of the various feeding stuffs is directly connected with the amount of crude fibre which they contain, for it is well known that this material is difficult of mastication and digestion in the state in which it is found in old grass, hay, straw, husks of cereal grains, &c. When the crude fibre is freed from the hard incrusting materials which accompany it in the case of coarse fodders, it has been found to have a high feeding value; in fact, it is then equivalent to starch. It is the difficulty of making the fibre fit for assimilation which withdraws so much energy from the body as to make that which comes from the food of little total gain; in other words, the net increase of energy in the body is slight. An illustration of this point would be furnished by comparing the animal body, regarded as a store of energy, with a reservoir of water into which water was being pumped from another and lower source, say a stream, by means of a ram pump. If the water used by the pump in forcing the supply to the reservoir were large in proportion to that which entered the reservoir owing to the resistance which the pump had to overcome, then the case could be compared with a feeding stuff of low availability. When, on the contrary, much of the water of

the stream was raised to the reservoir, and but little required by the pump, the illustration would apply to the case of a highly available feeding stuff. Foods easy of mastication and digestion throw only a small amount of work upon the animal machine, and so withdraw only a small proportion of the energy of the food which they are converting into an assimilable form.

It is interesting to notice, from figures which we owe to Kellner, and which are given below, that certain foods have a high availability, and if 100 be taken to represent a feeding stuff in which the nutrients behave in the animal body as though they had been fed in a pure isolated form, a direct comparison can be instituted. Actual feeding trials in which wheat gluten served as a pure form of protein, starch as carbohydrate, and a pure oil as fat, have formed the basis for Kellner's classification, which is as follows:—

AVAILABILITY OF CERTAIN FOODS.

(Full value = 100.)

	lb.		lb.
Linseed cake	97	Meadow hay	67—78
Decort. cotton cake	97	Clover ,, ...	70—74
Undecort. ,, ,, ...	84	Pasture grass	87—91
Cocoanut ,, ...	100	Red clover (young)	92
Sesame ,, ...	97	,, ,, (old)	83
Maize germ meal	97	Lucerne (according to age) ...	74—87
Dried brewers' grains	84	Wheat straw	32
Wet ,, ,, ...	86	Oat ,, ...	43
Oats	95	Barley ,, ...	46
Barley	99	Bean ,, ...	48
Maize	100	Pea ,, ...	44
Beans	97	Mangolds	70—74
Peas	98	Turnips	77
		Potatoes	100
		Cows' milk	100
		Whey	100

The above table shows that in the case of oil cakes, cereal grains, leguminous seeds, potatoes, milk and whey, the food nutrients are full value, or nearly so, whilst grass, clover, hay, straw, and roots cannot be placed on the same level, owing to the fact that their mastication and digestion throw work upon the animal organism, which means a deduction from the total amount which ought theoretically to be available for the body. Bye-products from the brewing, distilling, milling, and starch-making industries are also below full value, for during the processes of manufacture a large proportion of full-value food material has been

withdrawn, and what is left is not so valuable from the point of view of the availability of the nutrients contained therein. Potatoes have a full value because they contain a large amount of starch in a form which is easily prepared by the digestive apparatus for assimilation, and so no deduction need be made for the energy expended in these processes. Sugar, on the other hand, is not a full-value nutrient, because of the fermentative changes which it undergoes in the body and the consequent loss. For feeding purposes sugar is inferior to starch, and figures which will be quoted later give a direct comparison of these two materials for the formation of fat. Foods which contain much sugar in the dry matter, *e.g.*, mangolds, turnips, swedes, carrots, sorghum, and sugar-beet, are not equal to foods in which the chief carbohydrate material is in the form of starch.

Importance of Form in which the Digestible Nutrients are Present.—Kellner and those who have worked on similar lines have contributed a great deal towards founding a more rational system of valuing the various foodstuffs, for it will now be seen that if attention is paid solely to the digestible nutrients without any reference to their origin and the foods in which they are contained, very serious errors can be introduced in estimating their relative feeding values. If rations are made up without consideration being given to the origin of the digestible nutrients, it might easily happen that although the ration was theoretically sufficient for the needs of the animal, it might nevertheless prove to be inadequate owing to the fact that too much food of a low value (*i.e.*, food in which the nutrients were not full value or nearly so) was used. When the ration is composed of high value feeding stuffs the digestible nutrients behave practically the same as pure material of the same class. It is a matter of common knowledge that rations containing the same quantity of digestible food material do not behave alike in actual practice, and in some cases, probably in most, this failure is due to the form in which the nutrients are present in the foods composing the ration. Attention to this point, and, better still, the exact working out of the feeding value of the ration, will often show the reason for the failure to obtain the most satisfactory results.

Starch Equivalents.—Another point which has of late years been introduced into the theory and practice of animal nutrition, and which has served to simplify the method of making up rations, is also due to Kellner. It has long been felt that it would be very desirable if all feeding stuffs could have their value for feeding purposes expressed by a single number. Many standards of comparison have been proposed, and one of the most satisfactory is starch. It is again to Kellner that we are indebted for the experiments and ideas which have resulted in expressing each food in terms of starch. As the many accurate and painstaking experiments which he conducted showed how much fat was produced when given weights of starch were fed to full-grown oxen, and as it was comparatively easy to ascertain the increase in fat when known weights of certain foods or components of foods were fed, a direct comparison was afforded. It is not necessary to follow in detail the experiments which gave the information which led to the establishment of starch equivalents of foods. The general method was to keep full-grown animals upon a maintenance diet, *i.e.*, a diet upon which there was neither loss nor gain, and then find the increase in body fat as a result of feeding with the various foods. Actually in carrying out these experiments the animal was given sufficient food to cause it regularly to gain weight to a small extent; this prevented a decrease which would have been inimical to the success of the work. When starch was added to the maintenance diet of a full-grown ox it was found that for every 100 lb. of starch which were fed the animal increased in weight to the extent of 25 lb. in round figures. It may therefore be stated that when starch is fed to an animal which is already receiving as much food as it requires for maintenance purposes, the increase in fat is one-quarter of that of the starch fed. When sugar was fed instead of starch under the same conditions there was also an increase in body weight, although in this case the gain was not as much as in the case of starch. Protein in a pure state (wheat gluten) and oil behaved similarly in causing an increase of fat in the animal body. The actual figures are quoted for comparison in Table A on the next page.

TABLE A.

1 kilogram	(2·2 lb.) protein	gave	235 grams	(8·4 oz.)	fat
1 ,,	(2·2 lb.) starch	,,	248 ,,	(8·8 oz.)	,,
1 ,,	(2·2 lb.) cane sugar	,,	188 ,,	(6·7 oz.)	,,
1 ,,	(2·2 lb.) cellulose	,,	248 ,,	(8·8 oz.)	,,
1 ,,	(2·2 lb.) fat	,,	474—598 ,,	(16·7—21·1 oz.)	,,

Still more interesting is the fact that from the results of a very large number of actual trials conducted by Kellner and his associates, the conclusion can be drawn that the digestible nutrients in ordinary feeding stuffs behave as they do when fed in a pure form, as has been stated above. Naturally, the availability of each food must be taken into consideration, but where the contained nutrients are of full value the gain to the animal would be the same as though corresponding quantities of protein, starch, sugar, crude fibre, or fat had been given. This important fact connects theory with practice and enables anybody to say what is the value of certain foods when the amount of digestible nutrients and also the availability are known. As it has been, as we believe, accurately determined that starch, protein, &c., give rise under certain conditions to a fixed amount of fat, and that the nutrients in the common feeding stuffs behave in a similar manner, but are influenced as regards quantity by the greater or lesser difficulty which the animal body experiences in making them available, it is possible to assign to each food its equivalent in starch, which, of course, is a measure of the amount of fat which that particular food would give if used for an animal which was already on a maintenance diet.

Determination of Starch Equivalents.—The starch equivalents of foods can be determined in two ways, either by direct feeding trials with full-grown animals in which known weights of the feeding stuff are fed and the increase in body weight (fat) is noted, or by assigning a starch value to each nutrient, and then multiplying the amount of digested material (ascertained by chemical analysis and digestibility trials) by the factor appropriate to each.

Determination by Experiment.—Considering first of all the estimation of the starch equivalent by direct experiment, the case may be taken of where the addition of 100 lb. of meadow hay to the maintenance ration of an adult ruminant was found to result in a gain to the body of 8 lb. of fat. Know-

ing that 100 lb. of starch yield a quarter of their weight in fat (*i.e.*, 24·8, or, in round numbers, 25 lb.), it is seen that in order to produce 8 lb. of fat it would be necessary to feed 32 lb. of starch under the same conditions; thus 100 lb. of hay gave as much fat as 32 lb. of starch, and the starch equivalent of the hay becomes 32.

A further example is furnished in the case of 100 lb. of barley which yielded 18 lb. of fat, and converting this into the starch equivalent by multiplying by 4 the figure 72 is obtained.

It must not be concluded from the above that the starch equivalent applies only to foods that contain starch. The starch equivalent is really only a standard with which other foods can be compared, as the relation that exists between starch and body fat has been accurately ascertained. Foods such as meat meal (with a starch equivalent of 89·9), cow's milk, linseed cake, gluten meal, &c., have their respective starch equivalents, although they contain little or no starch at all.

The published starch equivalents have been derived almost without exception from experiments conducted in Germany, and so they primarily apply only to the foods and cattle of that country, or, more strictly considered, to the food and animal employed in each particular case. There is little reason, however, to suppose that British feeding stuffs would be found to differ very much, and as no provision is made in this country for repeating these determinations, those that are available must be accepted.

Determination by Calculation.—The starch equivalent of a food can also be determined by calculation if the following values are assigned to the nutrients:—

1 part digestible protein = 0·94 parts starch equivalent.
1 ,, ,, fat (in coarse fodders, chaff, roots and their bye-products) = 1·91 parts starch equivalent.
1 ,, ,, fat (in grains and their bye-products, except oil seeds) = 2·12 parts starch equivalent.
1 ,, ,, fat (from oil seeds and oil cakes) = 2·41 parts starch equivalent.
1 ,, ,, nitrogen-free extract substances (carbohydrates) and crude fibre together = 1·00 parts starch equivalent.

The calculation is then easy, although two points have to be borne in mind; firstly, that the digestible protein may contain some amide-like substances, which are sure to be digestible, but which are not regarded as having the feeding

value of true protein; and, secondly, the "availability" or "value" of the food must be considered. If the nutrients in the food are not full value (see p. 726) then the corresponding deduction must be made. Suppose, for example, that the starch value of cocoanut cake is found to be 76·5, as shown below, then the starch value requires no change to be made in it, for the nutrients are full value. When, however, oats are considered, the calculated starch equivalent has to undergo a deduction, because it has been shown that the nutrients in oats are not so highly available as those in linseed cake. In other words, whilst linseed cake is given the full value of 100, oats only receive 95. An example will make this clear; thus, taking oats to contain 9 per cent. of digestible protein, 5·25 per cent. of digestible oil, and 45 per cent. of digestible carbohydrates and crude fibre, and using the figures given above for the calculation of starch equivalents, we get:—

9	per cent.	protein	× 0·94 =	8·46	starch equivalent.
5·25	,,	oil	× 2·12 =	11·23	,,
45	,,	carbohydrates + crude fibre	× 1·00 =	45·00	,,
				64·69	

As the availability of food nutrients would only be 95 per cent., then $64·69 \times \frac{9}{10}\frac{6}{0} = 62$ for starch equivalent.

The figures representing the starch equivalent are included in the tables which are to be found in Kellner's books, the translation of the smaller of which has been published by Messrs. Duckworth and Co. under the title of "The Scientific Feeding of Animals." Some of the common feeding stuffs have starch equivalents as under:—

STARCH EQUIVALENTS OF CERTAIN FOODS.

	lb.		lb.
Linseed cake	71·8	Pasture grass	12
Decort. cotton cake	72·3	Red clover (young)	10
Undecort. ,, ,,	39·2	,, ,, (old)	9·7
Soya bean ,,	68	Lucerne (according to age)	8·4—9·1
Cocoanut ,,	76·5	Wheat straw	12
Sesame ,,	71	Oat ,,	17
Gluten meal	77	Barley ,,	19
Dried brewers' grains	50·3	Bean ,,	19
Wet ,, ,,	12·7	Pea ,,	16·2
Oats	63	Mangolds	7
Barley	74	Turnips	4·6
Maize	82·9	Potatoes	19
Beans	67	Cows' milk	14·7
Peas	68·6	Whey	6·4
Meadow hay	31		
Clover ,,	31		

Use of Starch Equivalents in Compounding Rations.—The next point to consider is whether the method of using starch equivalents to express the value of the feeding stuffs makes it easier to arrange a suitable ration for any class of stock. As is well known, certain feeding standards have been fixed for the different kinds of domestic animals, and although these standards are not entirely above criticism they nevertheless afford the most reliable information which is available at the present time. Kellner has ascertained the starch equivalents of foods which are required by animals under certain conditions, and in the table given below these figures are given, together with those which had, in the main, been previously regarded as standards:—

PER 1,000 LB. LIVE WEIGHT PER DAY.*

Animal.	Dry Matter in Ration.	Digestible Nutrients.				
		Protein.	Starch equivalent.	Crude Protein.	Fat.	Nitrogen Free Extract and Crude Fibre.
	lb.	lb.	lb.	lb.	lb.	lb.
Ox (full grown)	15—21	0·6—0·8	6·0	0·7	0·1	7·5— 9·5
Fattening bullock	24—32	1·5—1·7	12·5—14·5	1·8—2·2	0·7	13·0—16·0
Cow giving 10 lb. milk per 1,000 lb. live weight	22—27	1·0—1·3	7·8— 8·3	1·2—1·6	0·3	9·8—10·2
Cow giving 20 lb. milk per 1,000 lb. live weight	25—29	1·6—1·9	9·8—11·2	1·9—2 3	0·5	11·5—12·8
Cow giving 30 lb. milk per 1,000 lb. live weight	27—33	2·2—2·5	11·8—13·9	2·6—3·0	0·6	12·9—14·7
Cow giving 40 lb. milk per 1,000 lb. live weight	27—34	2·8—3·2	13·9—16·6	3·3—3·8	0·8	13·9—15·3
Horse, light work	18—23	1·0	9·2	1·2	0·4	9·8
,, heavy ,, ...	23—28	2·0	15·0	2·2	0·8	13·7
Young fattening pigs—						
2—3 months old	44	6·2	33·8	6·6	1·0	28·0
5—6 ,, ,, ...	32	3·5	26·5	4·4	0·7	22·5
Full-grown fattening pigs—						
1st period	33—37	3·0	27·5	3·9	0·7	26·0
2nd ,, ...	28—33	2·8	26·1	3·3	0·5	25·0
3rd ,, ...	24—28	2·0	19·8	2·6	0·4	19·0
Fattening sheep, full grown ...	24—32	1·6	14·5	1·9	0·7	16·0

Considering the above table of feeding standards, it will be noticed that one of the columns shows the amount of digestible true protein that is necessary for each animal, and that another column contains the starch equivalents.

It is very important indeed that sufficient true protein (albuminoids) should be given, for this material plays a part in the animal economy that no other food nutrient is

* The above table is taken from Kellner's standards; a full list appears in the "Scientific Feeding of Animals."

capable of doing. Although opinion on the question of how much protein is required by an animal has undergone some change during the past few years, it is nevertheless absolutely essential that at least the minimum should be contained in the ration, for no excess of any other ingredient can make up for the deficiency. When an animal is not receiving sufficient protein the effects are very marked and disastrous to its well-being. On that account, even when strict economy has to be practised, it is better to give some protein in excess of actual requirements so as to be on the safe side.

By using the starch equivalents of foods it is possible to simplify the making up of the ration very considerably, for, provided that the required amount of protein is allowed, all that it is necessary to do is to arrange for the ration to have a starch equivalent equal to that given in the feeding standards. The oil, the carbohydrates, and the total dry matter take a secondary position, and are chiefly useful as a check upon the other figures.

It must be clearly understood that the feeding standards refer to average foods fed under ordinary practical conditions to average animals. They cannot be regarded as absolute; in fact, feeding trials have shown that satisfactory rations can be made up which differ somewhat on one side or the other from the standards, but the latter serve to show whether any serious error is being made. Also, they allow of a ration being altered when circumstances require, and yet it can be seen whether the requisite amount of food is still being supplied.

Naturally attention must be paid to the palatableness of the ration, for experience has shown that insipid, tasteless food is not as thoroughly digested and utilised as that which the animal eats with relish. It is also necessary that the ration should be sufficiently bulky, for the digestive apparatus of all animals, and particularly ruminants, does not perform its work satisfactorily if the food is too condensed and lacks bulk. The conclusion arrived at seems therefore to be that given a palatable food which is bulky enough to meet the requirements of the animal the two main considerations are the digestible protein (which should not fall below the limits given) and the starch equivalent.

The facility with which a ration can be judged can be seen from the following examples :—

	Digestible protein. lb.	Starch equivalent. lb.
70 lb. of swedes	0·21	5·25
16 ,, oat straw	0·16	2·72
2 ,, decort. cotton cake... ...	0·79	1·44
	1·16	9·41

Suppose this ration to be fed to a cow of 1,000 lb. live weight giving 10 lb. of milk per day, then according to the table of feeding standards she would be receiving sufficient protein, and the starch equivalent would be ample. When the cow was giving more milk, say, double the quantity, then the digestible protein required would be from 1·6 to 1·9, and the starch equivalent would have to be from 9·8 to 11·2. According to Kellner's standards, a ration with more straw and cake would be needed, *e.g.* :—

	Digestible protein. lb.	Starch equivalent. lb.
70 lb. of swedes	0·21	5·25
20 ,, oat straw	0·20	3·40
4 ,, decort. cotton-cake ...	1·58	2·89
	1·99	11·54

These figures would be regarded as satisfactory, and could be checked by referring to the percentage of fat, which, as it is small in the case of swedes and oat straw, would come chiefly from the cotton cake. Cotton cake contains about 9 per cent. of oil, so in 4 lb. there would be 0·36 lb.; in addition 0·1 lb. would come from the straw, so that 0·46 lb. would be the total, which would be near enough to the standard.

Another ration suggested for a cow in full milk is the following :—

	Digestible protein. lb.	Starch equivalent. lb.
25 lb mangolds...	0·03	1·8
6 ,, hay	0·30	2·17
11 ,, oat straw...	0·11	1·87
4 ,, wheat meal	0·44	2·92
8 ,, bean ,, ...	1·60	6·00
	2·68	14·76

And it conforms very well with the standard already given for a cow yielding 40 lb. of milk per 1,000 lb. live weight per day.

A ration with less protein and starch equivalent is:—

	Digestible protein. lb.	Starch equivalent. lb.
33 lb. swedes	0·099	2·50
10 ,, meadow hay	0·38	3·10
20 ,, oat straw...	0·20	3·80
5 ,, crushed oats	0·05	3·10
2 ,, decort. cotton cake	0·79	1·44
	1·52	13·94

The starch equivalent can be used very satisfactorily for the making up of rations for fattening animals of all kinds. Reference to the table of feeding standards will show what is required in the several cases. It will be noticed that the standards for full-grown animals are less the further the period of fattening advances. This arrangement is more economical than continuing to give the amount with which a start was made right up to the end of fattening. The animal cannot utilise the full supply when it is nearing the point at which it can be considered to be finished.

With working horses an exactly similar course can be followed, and if the amount of digestible protein and the starch equivalent are calculated it will be seen how nearly any ration which is being fed conforms to the standard. A horse receiving 20 lb. of hay and 12 lb. of oats daily would be getting 1·4 lb. of digestible protein and 13·7 lb. starch equivalent. These amounts would suffice for an animal which was not doing particularly heavy work, but if more were expected, then extra food would have to be given. Beans would be a suitable addition, for they are rich in digestible protein, and they have a fairly high starch equivalent.

AGRICULTURAL CO-OPERATIVE CREDIT SOCIETIES IN ENGLAND AND WALES.

THIS article deals only with Co-operative Societies which concern themselves solely with the provision of loans of money to small agriculturists, and takes no account either of societies which make loans to dwellers in towns or of societies which may add the business of making advances to members to their main object of agricultural production, distribution, or supply.

It is possible to form an Agricultural Co-operative Credit Society under the Industrial and Provident Societies Act, with shares and share-capital and limited liability, but, as a matter of fact, all the societies of this character now in existence in England and Wales have been registered under the Friendly Societies Act, 1896, and the Special Authority granted by the Treasury in accordance with Section 8 (5) of the Act. A society registered under that Authority must have for its object the creation of funds by monthly or other subscriptions, to be lent out to, or invested for, the members of the society, or for their benefit, and must have in its rules provisions that no part of its funds shall be divided by way of profit, bonus, dividend, or otherwise, among its members, and that all money lent to members shall be applied to such purpose as the society or its committee of management may approve.

There is nothing in the Friendly Societies Act to prevent the registration of a society in which the liability of the members for the debts of the society is limited to a fixed sum in each case (or limited by guarantee, as it is called); but no society has yet been formed on this basis, and all the existing societies have adopted a rule to the following effect:—

"Every member of the Society shall be, equally with every other member, jointly and severally liable for all debts incurred by the Society, and for any loan which a member or his sureties may fail to pay."

Thus in all the existing societies the liability of each and all of the members for debts due by the society is unlimited, and the ultimate security offered by the society for advances made to it is the total property of all its members put together.

A society registered under the Friendly Societies Act has to submit its rules to the Chief Registrar, whose duty it is to satisfy himself that they are not contrary to the Act. Most of these societies have adopted the model rules recommended by the Agricultural Organisation Society, to which all but two of them are affiliated, and the others have rules which are in all important respects similar; so that regarding all of them it may be said that, besides the principle of unlimited liability, they have the following features in common.

No one can be admitted as a member unless he lives within a certain circumscribed area, such as a parish, or two or more adjoining parishes, and so is personally known to most of his fellow-members. He must also be approved by the committee as a man of good character, worthy of admission to the society. All the members have an equal voice in the election of the committee and the management of the society.

Loans to members are granted only on approved security, and must be utilised only for a specified purpose, which, in the opinion of the committee, is such that there is a sufficient prospect of the loan repaying itself by the production, business, or economy which it will enable the borrower to effect. No member can have out on loan more than £50 altogether at any time, though he can, of course, repay one loan and afterwards take out another, not exceeding £50.

The society may receive deposits, either from members or non-members, and may pay interest on them.

No profit may be divided among the members of the society. All profits must be carried to a reserve fund, which can only be drawn upon to meet exceptional losses by resolution of the general meeting of the society. Even if the society is dissolved, this reserve fund cannot be divided among the members, but must be spent on some useful purpose in the parish. Thus the only pecuniary benefit a man

may expect to gain by becoming a member of such a society is that of obtaining loans for profitable purposes connected with agriculture at a low rate of interest; and if a man is unlikely himself ever to require such a loan, his motive for joining as member can only be to help on a beneficial movement, and to assist his neighbours, by his guarantee and guidance, to get small loans on advantageous terms.

The accounts of the society, with the exception of those relating to individual loans and deposits, are open to the inspection of all interested in the funds. They must be audited annually and submitted to the Chief Registrar, and a copy of the annual balance-sheet must be conspicuously displayed for the information of all concerned.

At the end of 1910 there were in England and Wales 40 registered societies of the above type, scattered over twenty counties. Six of these were registered in 1895 and 1896, seven were registered in the three years 1904 to 1907, and in the last three years the numbers registered have been respectively seven, ten, and ten, so that the movement has recently shown signs of more rapid development.

Of these 40 societies, nine either sent in no returns or reported that they had as yet done no business. According to the annual returns for the year 1910, submitted to the Chief Registrar by the remaining 31 societies, they had at the end of the year 663 members—an average of 21 per society. They had during the year advanced 119 loans to their members, so that less than one in five of the members took out a loan during the year. The loans aggregated £1,390, and averaged £12 per loan; in individual cases they varied from £3 to £40. The earnings of these 31 societies during the year amounted to £147 (including a gift of £50), and the charges of the year were £82, so that there was a net profit on the year's working of £15, besides the gift. Their expenses of management, which are included in the above charges, amounted to £34, or a little over £1 per society. Their total assets amounted to £1,924, of which £1,421 were out on loans to members, and their total liabilities to £1,654, of which £489 were due to banks and £1,088 to depositors; and the total profits to date of all the 31 societies put together amounted to £270. This total includes gifts aggregating

£115, so that the profits actually earned to date were £155, an average of £5 per society.

It takes some years for a credit society to get into working order, and the progress made can be better judged by taking separately the totals for the six oldest societies, which have been at work for over fourteen years. Between them they had last year 145 members (an average of 24 per society), and during the year they gave out 34 loans, so that about one in four of the members got a loan. The loans aggregated £511, and averaged £15 per loan. The rate of interest charged on loans to members was, in four societies, 5 per cent., in one 6 per cent., and in one only 4 per cent. They had secured deposits amounting to £481, paying interest on them at 3 per cent. in four societies, and at 4 per cent. in one. Two of them had obtained advances from banks at 4 per cent., and one at 3 per cent. During the year they earned £36 in interest, and received other income amounting to £1, while their interest charge was only £20, and their expenses of management £6, an average of £1 per society; so that the net profit of the year was £11, or nearly £2 per society. Their assets amounted altogether to £743, including gifts of £65, and £556 out on loans to members; and their liabilities were £538, including the £481 held on deposit. Their surplus of assets over liabilities amounted to £205 (including the £65 received as gifts), so that they have now, after fourteen years of careful management, built up a reserve fund equal to more than one-third of what their members require in loans during the year. This is their own property, on which they have no interest to pay. The loans have been repaid punctually, and the societies have made no bad debts and incurred no losses, and only in three or four cases have they had to call on the sureties to help in repaying loans due from members. In hardly any case has the surety ultimately failed to recover the money from the actual borrower.

The loans were all taken out for purposes likely, in the opinion of the committee, to prove profitable, such as the purchase of sheep, pigs, cattle, horses, carts, implements, seed, manure, or cattle feed, or the employment of extra labour on the borrower's holding. The loans are generally made repayable about the time when the borrower may expect

to reap the return on his expenditure, and the date for repayment is therefore generally from six to twelve months after the date of the loan; some loans, however, were granted for two years, repayable by six-monthly or annual instalments.

The members agree in saying that they have derived great benefits from the existence of these societies, which have enabled many of them to obtain the small loans needed for their agricultural operations at a lower rate of interest than they would have had to pay elsewhere, and some of them to obtain loans who could not otherwise have borrowed at all. They cite instances of men who were enabled, by a loan from the society, to buy and feed sheep, pigs, or cattle, to hold over stock for better prices, to procure seed, plants, or manure, to work their land to better advantage, or to add to the area of their holdings, and of some who, by means of a succession of such loans, have risen from the position of labourers to that of substantial small-holders.

The establishment of these societies in the rural villages in which they are found has evidently not only added to the prosperity of many of the villagers, but has stimulated neighbourly feeling by showing men how they can help their fellows by the exercise of care and mutual trust, without any real pecuniary risk to themselves, has encouraged thrift and efficient methods of cultivation, and has at the same time increased the self-respect of the individual members, and inspired them with hopes of progress.

Serial Number.	County.	Name of Society.	Year of Registration.	Number of Members during the year. At beginning of year.	Number of Members during the year. At end of year.	Loans granted during the year. No.	Loans granted during the year. Amount. £	Rate of Interest received by the Society. On Loans to Members	Rate of Interest received by the Society. On other Advances and Investments.	Rate of Interest paid by the Society. On Deposits.	Rate of Interest paid by the Society. On Other Borrowings.
1	Lincoln	Scawby	1895	29	32	6	175	5	3‡	3	5*
2	Suffolk	Laxfield	1895	9	6	—	—	5	2½	3	—
3	Warwick	Grandborough	1895	7	7	—	—	—	—	—	—
4	Worcester	Castle Morton	1896	22	21	2	15	6	2½‡	3	4‡
5	Hampshire	Hedge End	1896	31	34	17	194	4	2½†	3	—
6	Norfolk	Wiggenhall	1896	46	45	9	127	5	3§	4	3*
		Total for six societies		144	145	34	511				
7	Lincoln	Friskney	1904	29	32	4	56	5	2½†	3	4 and 5‡
8	,,	Spalding	1904	81	76	—	—	5	5	4	—
9	Worcester	Far Forest	1904	7	7	—	—	6	2½†	4	3
10	Bedford	Clophill	1905	13	16	6	22	—	—	—	—
11	Norfolk	Whissonsett	1905	24	24	9	69	5	2½*	3	—
12	Hertford	Barley	1907	13	13	—	—	6	—	—	4‡
13	Leicester	Brookvale	1907	41	42	14	101	5	3*	3	4 and 5‡
		Total for seven societies		208	210	33	248				
14	Surrey	Dormansland	1908	24	24	—	—	—	—	—	—
15	Bucks	High Wycombe	1908	8	13	7	72	6	—	—	4½‡
16	Leicester	Mountsorrel	1908	24	27	3	121	5	—	2½	—
17	Kent	Bromley	1908	18	22	1	15	—	—	—	—
18	Hereford	Froomeshill	1908	12	13	—	—	—	—	—	—
19	Cambridge	Coates	1908	—	—	—	—	—	—	—	—
20	Middlesex	"All for Each," Southall	1908	9	9	—	—	6	—	3	—
21	Essex	Coggeshall	1909	16	20	4	49	5	—	—	—
22	,,	Tiptree	1909	21	26	12	168	5	—	—	4*
23	Glamorgan	St. Fagans	1909	14	13	—	—	—	—	—	—
24	Surrey	Limpsfield	1909	20	21	2	7	5	2½†	—	—
25	,,	Croydon	1909	24	24	—	—	5	2½	3	—
26	Norfolk	Trunch	1909	—	—	—	—	—	—	—	—
27	,,	Stiffkey	1909	—	—	—	—	—	—	—	—
28	Glamorgan	Cadoxton	1909	11	11	—	—	—	—	—	—
29	Bucks	Drayton Parslow	1909	8	22	10	101	6	0	3	5‡
30	Lincoln	Gedney Dyke	1909	—	—	—	—	—	—	—	—
31	Leicester	Oadby	1910	—	19	8	50	—	—	—	—
32	Norfolk	Wayford	1910	—	—	—	—	—	—	—	—
33	Kent	Halstead	1910	—	13	3	40	5	—	—	4*
34	Glamorgan	Barry	1910	—	11	—	—	—	—	—	—
35	Kent	High Halstow	1910	—	—	—	—	—	—	—	—
36	Oxford	Islip	1910	—	14	1	5	6	—	—	—
37	Surrey	Epsom	1910	—	—	—	—	—	—	—	—
38	Worcester	Cradley	1910	—	6	1	3	—	—	—	—
39	Oxford	Heyford	1910	—	—	—	—	—	—	—	—
40	Notts	Mansfield Woodhouse	1910	—	—	—	—	—	—	—	—
		Total for eighteen societies		209	308	52	631				
		Total for thirty-one societies reporting		561	663	119	1390				

* Joint Stock Bank. † Savings Bank. ‡ Central Bank.

(A) CASH TRANSACTIONS

Serial Number.	Name of Society.	Opening Balance Cash in hand and at Bank.	Cash Receipts. Loans Repaid by Members (Principal)	Other Advances and Investments Repaid (Principal)	Interest Received.	Deposits Received.	Other Borrowings.	Other Receipts.	Total Receipts (including Balance at Commencement of Year)
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£
1	Scawby	6 19 11	205 0 0	—	9 15 10	50 0 0	—	0 1 6	26 7
2	Laxfield	11 12 1	30 0 0	—	3 13 6	—	—	—	3 3
3	Grandborough	4 2 8	20 0 0	—	4 9 8	—	—	—	2 9
4	Castle Morton	18 16 8	42 14 2	—	3 7 6	—	—	0 4 0	4 5
5	Hedge End	39 3 6	164 0 0	—	6 4 2	8 0 0	—	0 7 6	17 1
6	Wiggenhall	26 12 5	90 0 0	—	5 14 10	0 2 6	8 1 11	—	10 9
Total for 6 Societies		107 7 3	551 14 2	—	33 5 6	58 2 6	8 1 11	0 13 0	65 7
7	Friskney	9 17 10	64 0 0	—	6 12 8	25 0 0	1 17 3	0 3 0	2 3
8	Spalding	159 4 8	—	—	0 3 0	3 0 0	—	7 10 0	1 5
9	Far Forest	0 11 1	—	—	—	—	—	—	
10	Clophill	0 1 9	22 0 0	—	1 4 0	—	20 0 0	1 8 3	4 2
11	Whissonsett	32 15 1	29 0 0	—	2 1 9	12 2 0	—	0 14 10	4
12	Barley	0 7 9	—	—	—	—	—	—	
13	Brookvale	0 0 8	53 0 0	—	2 14 9	—	60 0 0	0 2 3	11
Total for 7 Societies		202 18 10	168 0 0	—	12 16 2	40 2 0	81 17 3	9 18 4	31 3
14	Dormansland	0 6 11	—	—	—	—	—	—	
15	High Wycombe	—	1 5 0	—	—	—	70 0 0	1 10 6	7 5
16	Mountsorrell	—	20 5 0	—	0 14 0	127 0 0	—	1 7 5	14 6
17	Bromley	1 3 4	—	—	2 10 9	—	15 0 0	0 4 0	1 4
18	Froome's Hill	—	—	—	—	—	—	0 16 2	6
19	Coates	—	—	—	—	—	—	—	
20	All for Each	0 7 10	—	—	—	—	—	—	
21	Coggeshall	95 5 6	35 0 0	—	1 0 3	—	—	0 15 0	5 5
22	Tiptree	0 11 7	98 6 8	—	2 14 5	—	114 3 2	51 1 6	26 5
23	St. Fagan's	0 11 9	—	—	—	—	—	5 19 0	9
24	Limpsfield	3 16 0	3 10 0	—	0 3 6	5 0 0	—	0 5 0	8
25	Croydon	—	—	—	—	—	—	1 9 0	9
26	Trunch	—	—	—	—	—	—	—	
27	Stiffkey	—	—	—	—	—	—	—	
28	Cadoxton	—	—	—	—	3 1 0	—	2 11 11½	2
29	Drayton Parslow	—	—	—	—	—	100 0 0	2 17 6	10 7
30	Gedney Dyke	—	—	—	—	—	—	—	
31	Oadby	—	—	—	1 11 5	—	50 0 0	1 3 9	5 5
32	Wayford	—	—	—	—	—	—	—	
33	Halstead	—	—	—	—	—	40 0 0	1 12 6	4 2
34	Barry	—	—	—	—	—	—	2 10 0	0
35	High Halstow	—	—	—	—	—	—	—	
36	Islip	—	—	—	—	—	7 10 0	1 9 0	9
37	Epsom	—	—	—	—	—	—	—	
38	Cradley	—	—	—	—	3 14 8	—	1 17 0	1
39	Heyford	—	—	—	—	—	—	—	
40	Mansfield Woodhouse	—	—	—	—	—	—	—	
Total for 18 Societies		102 2 11	158 6 8	—	8 14 4	138 15 8	396 13 2	77 9 3½	77 9
Total for 31 Societies		412 9 0	878 0 10	—	54 16 0	237 0 2	486 12 4	88 0 7½	1,74 9

YEAR.

CASH PAYMENTS.								
Other Borrowings Repaid.	Interest Paid.	Loans Advanced to Members.	Other Advances and Investments.	Expenses of Management.	Other Payments.	Carried to Reserve Fund (Separate Account).	Total Payments of the Year.	Closing Balance, Cash in Hand and at Bank.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
—	3 10 5	175 0 0	75 0 0	0 12 0	—	—	254 2 5	17 14 10
—	2 2 0	—	—	0 5 0	—	—	32 7 0	12 18 7
—	4 9 8	—	—	—	—	—	24 9 8	4 2 8
—	1 19 8	15 0 0	—	0 13 6	—	—	17 13 2	47 9 2
—	4 7 9	194 0 0	—	1 8 2	—	—	207 15 11	9 19 3
—	0 2 7	127 0 0	—	3 3 1	—	—	130 5 8	0 6 0
—	16 12 1	511 0 0	75 0 0	6 1 9	—	—	666 13 10	92 10 6
—	3 17 0	56 0 0	—	1 8 9	—	—	107 5 9	0 5 0
—	6 4 0	—	—	1 12 6	—	—	21 18 2	147 19 6
—	—	—	—	0 0 10	—	—	0 0 10	0 10 3
20 0 0	0 15 2	22 0 0	—	0 19 6	—		43 14 8	0 19 4
1 14 6	1 17 2	69 0 0	—	0 6 9	0 5 0	—	73 3 5	3 10 3
—	—	—	—	—	—	—	—	0 7 9
5 0 0	—	100 12 6	—	1 0 9½	0 14 10	—	107 8 1½	8 9 6½
26 14 6	12 13 4	247 12 6	—	5 9 1½	0 19 10	—	353 10 11½	162 1 7½
—	—	—	—	—	—	—	—	0 6 11
—	—	72 0 0	—	0 18 5	—	—	72 18 5	0 2 11*
—	—	121 0 0	—	0 10 0	—	—	121 10 0	27 16 5
—	—	15 0 0	—	1 8 9½	—	—	16 18 9½	1 19 3½
—	—	—	0 5 0	0 4 0	0 9 0	—	0 18 0	0 1 10*
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	0 7 10
—	—	49 0 0	—	1 9 4	—	—	50 9 4	81 11 5
93 11 7	1 3 11	168 0 0	—	3 11 4	0 10 6	—	266 17 4	—
—	—	—	—	0 6 7	0 2 6	—	0 9 1	6 1 8
—	—	7 0 0	—	1 6 2	—	—	8 6 2	4 8 4
—	—	—	—	1 6 7½	—	—	1 6 7½	0 2 4½
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	2 10 5½	—	—	3 5 5½	2 7 6
—	0 19 3	101 10 0	2 10 0	1 10 2	—	—	106 9 5	3 11 11*
—	—	—	—	—	—	—	—	—
—	1 6 8	50 0 0	2 10 0	1 12 0	—	—	55 8 8	2 13 6*
—	—	—	—	—	—	—	—	—
—	—	40 0 0	—	1 10 2	—	—	41 10 2	0 2 4
—	—	—	—	1 8 6	—	—	1 8 6	1 1 6
—	—	—	—	—	—	—	—	—
—	—	5 0 0	2 10 0	1 0 6	—	—	8 10 6	0 8 6
—	—	—	—	—	—	—	—	—
—	—	3 0 0	—	1 11 0	—	—	5 4 6	0 7 2
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
93 11 7	3 9 10	631 10 0	7 15 0	22 4 0½	1 2 0	—	761 10 11½	120 11 1
120 6 1	32 15 3	1,390 2 6	82 15 0	33 14 11	2 1 10	—	1,781 15 9	375 3 2½

* Due to Treasurer.

(B) PROFIT AND

Serial Number.	Name of Society.	Balance of Profit of Previous Years, including Reserve Fund.	Earnings of the Year.		
			Interest earned within the year.	Other Income.	Total Earnings.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	Scawby	59 10 0	11 11 4	0 1 6	11 12 10
2	Laxfield	11 12 1	3 13 6	—	3 13 6
3	Grandborough	4 7 2	4 9 8	—	4 9 8
4	Castle Morton	4 0 10	3 7 6	0 4 0	3 11 6
5	Hedge End	38 4 4	6 19 6	0 7 6	7 7 0
6	Wiggenhall	76 7 1	5 16 0	—	5 16 0
	Total for 6 Societies	194 1 6	35 17 6	0 13 0	36 10 6
7	Friskney	5 7 10	6 12 8	0 3 0	6 15 8
8	Spalding	0 10 7	7 13 0	—	7 13 0
9	Far Forest	0 19 1	—	—	—
10	Clophill	0 1 9	1 4 0	1 8 3	2 12 3
11	Whissonsett	2 12 4	2 1 9	0 14 10	2 16 7
12	Barley	0 7 9	—	—	—
13	Brookvale	0 19 11	10 16 3½	0 2 3	10 18 6½
	Total for 7 Societies	10 19 3	28 7 8½	2 8 4	30 16 0½
14	Dormansland	—	—	—	—
15	High Wycombe	—	0 13 1	1 10 6	2 3 7
16	Mountsorrel	—	0 14 0	1 7 5	2 1 5
17	Bromley	—	0 9 0	0 5 9	0 14 9
18	Froome's Hill	—	—	0 16 2	0 16 2
19	Coates	—	—	—	—
20	All for Each	0 4 10	—	—	—
21	Coggeshall	1 5 6	1 0 3	0 15 0	1 15 3
22	Tiptree	—	3 13 1	50 7 0	54 0 1
23	St. Fagan's	0 11 9	—	1 0 0	1 0 0
24	Limpsfield	0 16 0	0 4 1	0 5 0	0 9 1
25	Croydon	—	—	1 9 0	1 9 0
26	Trunch	—	—	—	—
27	Stiffkey	—	—	—	—
28	Cadoxton	—	—	2 11 11½	2 11 11½
29	Drayton Parslow	—	0 18 0	2 17 6	3 15 6
30	Gedney Dyke	—	—	—	—
31	Oadby	—	1 11 5	1 3 9	2 15 2
32	Wayford	—	—	—	—
33	Halstead	—	—	1 12 6	1 12 6
34	Barry	—	—	1 9 0	1 9 0
35	High Halstow	—	—	—	—
36	Islip	—	—	1 9 0	1 9 0
37	Epsom	—	—	—	—
38	Cradley	—	—	1 17 0	1 17 0
39	Heyford	—	—	—	—
40	Mansfield Woodhouse	—	—	—	—
	Total for 18 Societies	2 18 1	9 2 11	70 16 6½	79 19 5½
	Total for 31 Societies	207 18 10	73 8 1½	73 17 10½	147 6 0

COUNT OF THE YEAR.

Charges of the Year.				Balance profit or loss on the year's working + or −	Debts to Society written off during the year.	Grand total of profit or loss to date at end of year + or −
Interest charge incurred within the year.	Expenses of Management.	Other Expenditure.	Total charges of the year.			
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
14 5	0 12 0	—	6 6 5	+ 5 6 5	—	+64 16 5
2 0	0 5 0	—	2 7 0	+ 1 6 6	—	+12 18 7
9 8	—	—	4 9 8	—	—	+ 4 7 2
19 8	0 13 6	—	2 13 2	+ 0 18 4	—	+ 4 19 2
7 9	1 8 2	—	5 15 11	+ 1 11 1	—	+39 15 5
17 7	3 3 1	—	4 0 8	+ 1 15 4	—	+78 2 5
11 1	6 1 9	—	25 12 10	+10 17 8	—	+204 19 2
17 0	1 8 9	—	5 5 9	+ 1 9 11	—	+ 6 17 9
4 0	1 12 6	—	7 16 6	− 0 3 6	—	+ 0 7 1
—	0 0 10	—	0 0 10	− 0 0 10	—	+ 0 18 3
15 2	0 19 6	—	1 14 8	+ 0 17 7	—	+ 0 19 4
17 2	0 6 9	0 5 0	2 8 11	+ 0 7 8	—	+ 3 0 0
—	—	—	—	—	—	+ 0 7 9
15 2	1 0 9½	1 0 4½	8 16 4	+ 2 2 2½	—	+ 3 2 1½
3 6	5 9 1½	1 5 4½	26 3 0	+ 4 13 0½	—	+15 12 3½
—	—	—	—	—	—	− 0 8 1
9 0	2 7 11	—	2 16 11	− 0 13 4	—	− 0 13 4
—	0 10 0	—	0 10 0	+ 1 11 5	—	+ 1 11 5
—	1 8 9½	—	1 8 9½	− 0 14 0½	—	− 1 7 8½
—	0 4 0	0 9 0	0 13 0	+ 0 3 2	—	− 0 3 0
—	—	—	—	—	—	—
—	—	—	—	—	—	+ 0 4 10
—	1 9 4	—	1 9 4	+ 0 5 11	—	+ 1 11 5
3 11	2 9 10	—	3 13 9	+50 6 4	—	+48 19 3
—	0 6 7	0 2 6	0 9 1	+ 0 10 11	—	+ 1 2 8
—	1 6 2	—	1 6 2	− 0 17 1		− 0 1 1
—	1 6 7½	3 9 0	4 15 7½	− 3 6 7½	—	− 3 6 7½
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	2 10 5½	—	2 10 5½	+ 0 1 6	—	+ 0 1 6
19 3	1 10 2	—	2 9 5	+ 1 6 1	—	+ 1 6 1
—	—	—	—	—	—	—
6 8	1 12 0	—	2 18 8	− 0 3 6	—	− 0 3 6
—	—	—	—	—	—	—
—	1 10 2	—	1 10 2	+ 0 2 4	—	+ 0 2 4
—	1 8 6	—	1 8 6	+ 0 0 6	—	+ 0 0 6
—	—	—	—	—	—	—
—	1 0 6	—	1 0 6	+ 0 8 6	—	+ 0 8 6
—	—	—	—	—	—	—
—	1 11 0	—	1 11 0	+ 0 6 0	—	+ 0 6 0
—	—	—	—	—	—	—
—	—	—	—	—	—	—
18 10	22 12 0½	4 0 6	30 11 4½	+49 8 1	—	+49 11 2
13 5	34 2 11	5 5 10½	82 7 2½	+64 18 9½	—	+270 2 7½

(C) BALANCE SHEET AS T

Serial No.	Name of Society.	ASSETS. Cash in Hand and at Bank.	Investments.	Loans due from Members (Principal).	Interest Accrued but not Received.	Reserve Fund held on Separate Account.	Other Assets.	Total Assets.	Ov... Re... in... in... A...
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£
1	Scawby	17 14 10	82 10 0	150 0 0	5 2 1	—	—	255 6 11	
2	Laxfield	12 18 7	—	40 0 0	—	—	—	52 18 7	
3	Grandborough	4 2 8	—	79 14 0	—	—	—	83 16 8	
4	Castle Morton	47 9 2	2 10 0	6 10 0	—	—	—	56 9 2	
5	Hedge End	9 19 3	—	173 0 0	1 16 2	—	—	184 15 5	
6	Wiggenhall	0 6 0	0 1 0	107 0 0	2 14 6	—	—	110 1 6	
	Total for 6 Societies	92 10 6	85 1 0	556 4 0	9 12 9	—	—	743 8 3	
7	Friskney	0 5 0	2 10 0	133 0 0	—	—	—	135 15 0	
8	Spalding	147 19 6	—	3 0 0	—	—	—	150 19 6	
9	Far Forest	0 10 3	—	0 3 0	—	—	0 5 0	0 18 3	
10	Clophill	0 19 4	—	—	—	—	—	0 19 4	
11	Whissonsett	3 10 3	—	71 10 0	—	—	—	75 0 3	
12	Barley	0 7 9	2 10 0	—	—	—	—	2 17 9	
13	Brookvale	8 9 6½	2 10 0	148 9 3	—	—	2 5 0	161 13 9½	
	Total for 7 Societies	162 1 7½	7 10 0	356 2 3	—	—	2 10 0	528 3 10½	
14	Dormansland	0 6 11	—	—	—	—	—	0 6 11	
15	High Wycombe	—	—	70 15 0	0 13 1	—	—	71 8 1	
16	Mountsorrel	27 16 5	—	100 15 0	—	—	—	128 11 5	
17	Bromley	1 19 3½	2 10 0	13 0 0	—	—	0 13 0	18 2 3½	
18	Froome's Hill	—	0 5 0	—	—	—	—	0 5 0	
19	Coates	—	—	—	—	—	—	—	
20	All for Each Southall	0 7 10	—	—	—	—	—	0 7 10	
21	Coggeshall	81 11 5	—	20 0 0	—	—	—	101 11 5	
22	Tiptree	—	—	99 13 4	1 4 6	—	2 4 7	103 2 5	
23	St. Fagan's	6 1 8	—	—	—	—	—	6 1 8	
24	Limpsfield	4 8 11	—	5 10 0	—	—	—	9 18 11	
25	Croydon	0 2 4½	—	—	—	—	—	0 2 4½	
26	Trunch	—	—	—	—	—	—	—	
27	Stiffkey	—	—	—	—	—	—	—	
28	Cadoxton	2 7 6	—	—	—	—	—	2 7 6	
29	Drayton Parslow	—	2 10 0	101 10 0	0 18 0	—	—	104 18 0	
30	Gedney Dyke	—	—	—	—	—	—	—	
31	Oadby	—	2 10 0	50 0 0	—	—	—	52 10 0	
32	Wayford	—	—	—	—	—	—	—	
33	Halstead	0 2 4	—	40 0 0	—	—	—	40 2 4	
34	Barry	1 1 6	—	—	—	—	—	1 1 6	
35	High Halstow	—	—	—	—	—	—	—	
36	Islip	0 8 6	—	5 0 0	—	—	2 10 0	7 18 6	
37	Epsom	—	—	—	—	—	—	—	
38	Cradley	0 7 2	—	3 0 0	—	—	—	3 7 2	
39	Heyford	—	—	—	—	—	—	—	
40	Mansfield Woodhouse	—	—	—	—	—	—	—	
	Total for 18 Societies	127 1 10	7 15 0	509 3 4	2 15 7	—	5 7 7	652 3 4	
	Total for 31 Societies reporting	381 13 11½	100 6 0	1,421 9 7	12 8 4	—	7 17 7	1,923 15 5½	

DECEMBER, 1910.

Liabilities.						Balance being total Profit or Loss to date (including Reserve Fund).	
Due to other non-members (principal).	Due to members on deposits (principal).	Interest accrued but not paid.	Other Liabilities.	Total Liabilities.		Profit.	Loss.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.
101 0 0	85 0 0	4 10 6	—	190 10 6		64 16 5	—
40 0 0	—	—	—	40 0 0		12 18 7	—
79 9 6	—	—	—	79 9 6		4 7 2	—
7 10 0	—	—	—	51 10 0		4 19 2	—
40 0 0	105 0 0	—	—	145 0 0		39 15 5	—
—	23 2 2	0 15 0	8 1 11	31 19 1		78 2 5	—
267 19 6	213 2 2	5 5 6	8 1 11	538 9 1		204 19 2	—
127 0 0	—	—	1 17 3	128 17 3		6 17 9	—
—	150 12 5	—	—	150 12 5		0 7 1	—
—	—	—	—	—		0 18 3	—
—	—	—	—	—		0 19 4	—
—	72 0 3	—	—	72 0 3		3 0 0	—
2 10 0	—	—	—	2 10 0		0 7 9	—
0 16 6	—	6 15 2	—	158 11 8		3 2 1½	—
130 6 6	222 12 8	6 15 2	1 17 3	512 11 7		15 12 3½	—
0 15 0	—	—	—	0 15 0		—	0 8 1
—	—	0 9 0	1 12 5	72 1 5		—	0 13 4
127 0 0	—	—	—	127 0 0		1 11 5	—
2 10 0	—	—	2 0 0	19 10 0		—	1 7 8½
—	—	—	0 8 0	0 8 0		—	0 3 0
—	—	—	—	—		—	—
—	0 3 0	—	—	0 3 0		0 4 10	—
—	100 0 0	—	—	100 0 0		1 11 5	—
—	—	—	—	54 3 2		48 19 8	—
—	4 19 0	—	—	4 19 0		1 2 8	—
10 0 0	—	—	—	10 0 0		—	0 1 1
—	—	—	3 9 0	3 9 0		—	3 6 7½
—	—	—	—	—		—	—
—	—	—	—	—		—	—
—	2 6 0	—	—	2 6 0		0 1 6	—
—	—	—	3 11 11	103 11 11		1 6 1	—
—	—	—	—	—		—	—
—	—	—	2 13 6	52 13 6		—	0 3 6
—	—	—	—	—		—	—
—	—	—	40 0 0	40 0 0		0 2 4	—
1 1 0	—	—	—	1 1 0		0 0 6	—
—	—	—	—	—		—	—
—	2 10 0	—	—	7 10 0		0 8 6	—
—	—	—	—	—		—	—
—	3 1 2	—	—	3 1 2		0 6 0	—
—	—	—	—	—		—	—
—	—	—	—	—		—	—
141 6 0	112 19 2	0 9 0	53 14 10	602 12 2		55 14 6	6 3 4
539 12 0	548 14 0	12 9 8	63 14 0	1,653 12 10		276 5 11½	6 3 4

THE IDENTIFICATION AND ERADICATION OF SOME COMMON WEEDS.

III.*

HAROLD C. LONG, B.Sc. (EDIN.),

With Drawings from Nature by BERTHA REID.

CORN PANSY.

The Corn Pansy or Heartsease (*Viola tricolor*, L.), with various sub-species, is found chiefly on arable and waste land, and is widely distributed. It occurs on calcareous soils, but more frequently on light sandy land. Brenchley found it absent or exceedingly rare on clays and heavy land.† It is a pretty and very variable annual. The name Pansy is apparently derived from *Pauncé, Pensée,* and hence the old saying, "Pansie for thoughts," the pansy being generally accepted as the symbol of remembrance or constancy. Hence the name Herb Constancy for this little plant, which is also termed Wild Pansy and Pansy Violet. Shakespeare makes Ophelia say:—"There's pansies, that's for thoughts."

Seeds.—The seeds (Fig. 1, *a*) of *Viola tricolor* are commonly present in samples of Timothy, Alsike, and other grass and clover seeds, and are a very undesirable impurity. Burchard ‡ describes the seed as shaped like a thick comma, with a sharp point. It is about $\frac{1}{20}$ to $\frac{1}{16}$ in. (1·2 to 1·5 mm.) in length, evenly coloured light brown or yellowish-brown to fairly dark brown, smooth and usually somewhat shiny, and the hilum is at one side near the pointed end or projection, which is slightly lighter in colour than the rest of the seed. The seed is slightly flattened, and many specimens show clear depressions on the flattened sides; it is more or less conical, but owing to the compression referred to has a strong tendency to lie in a particular position, and when moved rolls over to that position. Fresh seed is plump, hard, and slippery.

Seedlings.—In its early stage (Fig. 1, *b*) the seedling has

* The previous articles appeared in the *Journal* for July, 1911, p. 288, and September, 1911, p. 460.

† "Weeds in Relation to Soils," W. E. Brenchley: *Journal of the Board of Agriculture*, April, 1911, p. 18.

‡ *Die Unkrautsamen*, O. Burchard, 1900, p. 23.

FIG. 1.—CORN PANSY (*Viola tricolor*, L.).

a, Seed, nat. size and ×4½; *b*, early stage of seedling ×1; *b′*, surface view of two typical forms of cotyledons ×1½; *c*, second stage of seedling ×1; *d*, third stage of seedling ×1; *e*, flowering portion ×1; *e′*, surface view of flower ×1.

FIG. 2.—FIELD MADDER (*Sherardia arvensis*, L.).

a, Fruit, nat. size and ×4; *b*, early stage of seedling ×1; *b′*, surface view of cotyledon ×1; *c*, second stage of seedling ×1; *d*, third stage of seedling ×1; *e*, flowering portion ×½; *e′*, flower magnified.

a finely fibrous root, and the hypocotyl is long, slender, smooth, and pearly. The cotyledons (Fig. 1, *b'*) are very variable in shape, and may be round-oval, nearly oval, or nearly lanceolate; they are broader towards the base, light green, smooth, and shortly petioled, the petiole being channelled above and tinged brownish. The blade of the cotyledon is $\frac{1}{10}$ to $\frac{1}{4}$ in. long by $\frac{1}{15}$ to $\frac{1}{5}$ in. broad (2·5 to 6 mm. long by 1·7 to 5 mm. broad).

In the second stage seedling (Fig. 1, *c*) the cotyledons have attained their maximum growth, and the petioles are roughly as long as the blades of the cotyledons. The first leaves are radical, petiolate, broadly ovate, with notched margins, and have a well-marked mid-rib, with veins clearly showing at the back. The stalks are long, rather broad, channelled above, convex below, and slightly and minutely hairy.

The third stage seedling (Fig. 1, *d*) shows a central stem, while incipient branches are appearing. The leaves are larger and more clearly notched at the margins; they are light green above, and silvery beneath, with central mid-rib or vein alternately branched. A few minute hairs occur on the leaf stalks and margins.

Mature Plant.—The plants grow quickly, and when they reach the flowering stage (Fig. 1, *e*) are 6 to nearly 18 in. high, and the stem is angular and branched, with a large pinnatifid stipule on each side of the leaves. The flowers (Fig. 1, *e* and *e'*) spring from the axils of the leaves with the stem, and are borne on long stalks; they are $\frac{1}{4}$ to $1\frac{1}{4}$ in. in diameter, and, as the specific name *tricolor* implies, are roughly three-tinted, the colours being very variable—whitish purple, lilac, pale yellow or golden yellow, sometimes particoloured. The flowering-period is from May to September, and the plant is widely distributed in Europe, Northern Africa, Asia, North-West India, and America. The fruit is a three-valved capsule containing many of the hard, slippery seeds. There are large numbers of cultivated varieties of *Viola tricolor,* which are among the most beautiful of our garden flowers. Anne Pratt states that "The flower, when bruised, has a faint scent of peach kernels, an odour which is more powerful in the cultivated kinds, and

which is communicated to water in which the heartsease is distilled." *

Prevention and Remedy.—The Corn Pansy is an annual which produces an abundance of seed, and hence must be combated by surface cultivation, and the free use of the hoe among roots after corn. Care should be taken that pure samples of clover and grass seeds are sown.

FIELD MADDER.

Field Madder (*Sherardia arvensis,* L.) is a small prostrate annual which is often plentiful on cultivated land, especially on light sandy loams and calcareous soils. Brenchley found that in the district between Harpenden and Bedford the weed is frequent on clays and heavy soils, as well as on sandy soils and light loams, while it is "symptomatic" of the chalk. Anne Pratt remarks that "The plant abounds in the ridges of cornfields, and on dry banks, especially where the soil is of gravel." It is, perhaps, most generally found in "seeds," and the fruits are a common impurity in samples of red clover, Italian ryegrass, and "seeds" mixtures. The generic name is after the botanist Sherard.

Fruits.—The seed of Field Madder is enclosed in a fruit (Fig. 2, *a*), which is small and rough, and crowned by three erect, persistent, spiny calyx teeth. The fruits are two-lobed, ashy-grey to grey-brown in colour, owing to numerous fine white hairs closely pressed to the fruit. Each lobe is somewhat egg-shaped, rather flattened on one side, and furrowed lengthwise on that side. The total length is about $\frac{1}{12}$ to $\frac{1}{8}$ in. (2 to 3 mm.), and the breadth $\frac{1}{20}$ to $\frac{1}{15}$ in. (1·2 to 1·7 mm.) broad. The fruits are a very common impurity in the seeds of clovers and grasses throughout Europe.

Seedlings.—The first stage seedling (Fig. 2, *b*) shows a well-developed fibrous root-system, the roots being yellowish in colour. The hypocotyl is light green and smooth. The cotyledons (Fig. 2, *b'*) are broadly ovate to roundish, fleshy, smooth, dark green, with very short broad petiole, and clearly three-nerved from the base; they are $\frac{1}{4}$ to $\frac{3}{8}$ in. (6 to 9 mm.) in total length, and $\frac{1}{6}$ to $\frac{3}{10}$ in. (4 to 7·5 mm.) broad, enlarging as the seedling grows.

* *Flowering Plants*, Anne Pratt, vol. i., p. 177.

In the second stage seedling (Fig. 2, *c*) the hypocotyl may have become yellowish or even tinged with red. The central stem rises from between the cotyledons, and also a pair of opposite branches—the stem is branched from the base. The stems are rather angular and sparsely hairy. The leaves are cauline, and, with the leaf-like stipules, are usually in whorls of four; they are oblong-lanceolate, somewhat narrow at the base and broad towards the apex, which terminates in a short awn, while they are sparsely hairy, but regularly so round the margins.

The third stage seedling (Fig. 2, *d*) clearly shows the branching character of the plant and the strong root-system, while the leaves and leaf-like stipules are now in whorls of four to six, and the whole plant is rough to the touch.

Mature Plant.—The grown plant is low and spreading in habit—nearly prostrate—much branched, and with stems up to about 18 inches in length. The leaves are narrow, obovate-lanceolate, pointed, under an inch long, and, with the very similar stipules, in whorls of four to six. The flowers are in terminal sessile clusters, are individually about $\frac{1}{8}$ in. in diameter, and lilac in colour; they open between April and October. The fruits have been already described.

Prevention and Remedy.—Care must be taken to prevent the introduction of the seeds with clover and grass seeds. The weed is an annual which must be combated by means of surface cultivation from early spring onwards, by the free use of the hoe, and by hand-pulling where it occurs in "seeds." Clean cultivation and the growth of heavy crops should suffice to keep this weed in abeyance.

CLEAVERS.

Cleavers (*Galium Aparine,* L.) is a well-known weed which has received a large number of trivial names, among them being Clithe, Cliver, Cliders, Goose-grass, Goosebill, Hariff, Grip-grass, Catch-weed, Love-man, Scratch-weed, and Robin-run-over-the-hedge, many of which bear obvious relation to the rough clinging character of the weed. It is a weak, lanky, straggling hook climber, and occurs on most soils on arable land, being particularly troublesome among cereal crops, especially on light loamy soils. It climbs among the corn for

support, and by sheer weight drags it down, rendering harvesting operations difficult. Brenchley found it frequent alike on clays, chalk soils, and sands and light loams, while it was absent or very rare in seed-crops. Holdich wrote* that cleavers is "principally addicted to deep, loose soils, mellow, marshy land, and the drier sorts of fen land. All lightish loams may have hariff, but it abhors clay, and fen soils lying damp and low are not friendly to it, though it be one of the very worst weeds where it abounds. The farmers of clay lands on the verge of the fens often buy their seed wheat of the fen farmers; and they heed not the seeds of hariff for, if they grow, they come to no length, and are never seen at harvest."

Cleavers is frequently chopped up and given as a food to poultry; Hulme says† that "the whole plant gives a decoction equal to tea"; and William Pitt, Harz, and Anne Pratt state that the seeds (fruits) form a substitute for coffee; while Harz adds that when roughly ground they can with advantage be used as a cattle food.‡ Anne Pratt also says of this weed: "Dioscorides tells that it was used in his time as a kind of filter for straining milk, and Linnæus says it is commonly so used in Sweden. In our own country places it is occasionally thus employed, when a sieve is not at hand, and it answers the purpose exceedingly well, by the roughness of its leaves and stalks." Ewart says § that the weed is eaten by stock when hungry, but, though not poisonous, it is apt to cause internal inflammation, and has a certain diuretic action.

Fruits.—As in the case of *Sherardia arvensis* the seed of *Galium Aparine* is enclosed in a rough fruit, which is rather large, roundish, but somewhat compressed from above to the scar beneath, hard, grey-green to purplish in colour when ripe, and very rough, owing to numerous hooks by means of which it clings to the clothes of man or the hair and fur of animals, so ensuring distribution (Fig. 3, *a*). The fruits are

* "An Essay on the Weeds of Agriculture," Benjamin Holdich. Edited by G. Sinclair, 3rd edition, 1825.

† *Familiar Wild Flowers*, F. E. Hulme, Vol. v., p. 103.

‡ *Landwirtschaftliche Samenkunde*, C. D. Harz, 1885.

§ *Weeds, Poison Plants, and Naturalised Aliens of Victoria*, A. J. Ewart, 1909, p. 31.

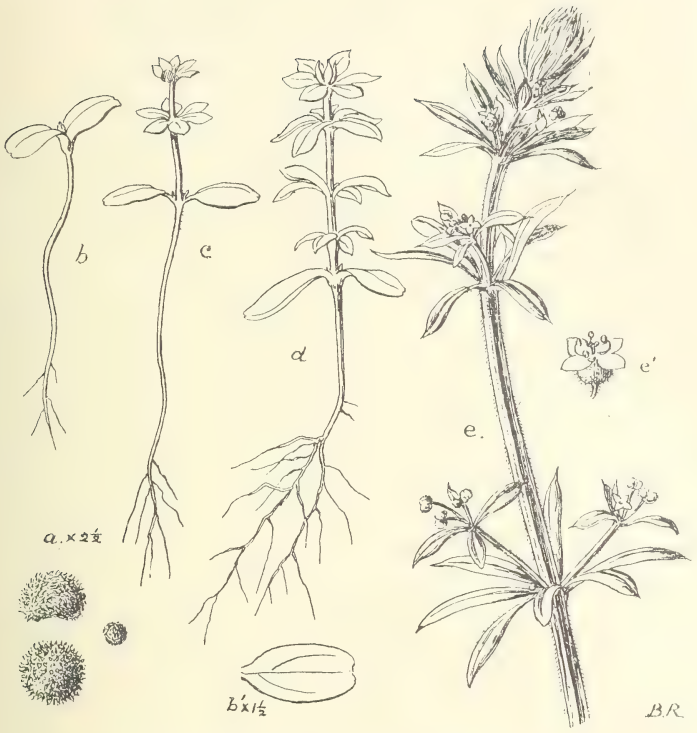

FIG. 3.—CLEAVERS (*Galium Aparine*, L.).

a, Fruit, nat. size and × 2½; *b*, early stage of seedling × 1; *b'*, surface view of cotyledon × 1½; *c*, second stage of seedling × 1; *d*, third stage of seedling × 1; *e*, flowering and fruiting portion × 1; *e'*, flower magnified.

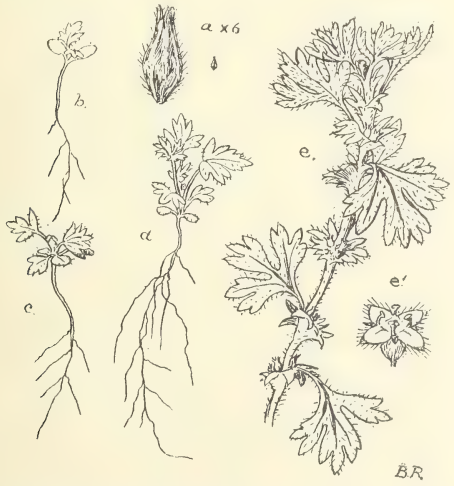

FIG. 4.—FIELD LADY'S MANTLE (*Alchemilla arvensis*, Lamk.).

a, Fruit, nat. size and × 6; *b*, early stage seedling × 1; *c*, second stage seedling × 1; *d*, third stage seedling × 1; *e*, flowering portion × 1; *e'*, flower magnified.

two-lobed, each lobe containing a seed, and the under side of each bears a shallow roundish depression or hollow; they are $\frac{1}{12}$ to $\frac{1}{8}$ in. (2 to over 3 mm.) in diameter, and $\frac{1}{12}$ to $\frac{1}{10}$ in. (2 to 2·5 mm.) thick. Burchard describes the fruit as grey in colour, warty, with short curved whitish spines on the warts; the outer coat may be lost during threshing operations, and the seed is then seen to be smooth and grey-brown. The fruits are much too common in clover and many grass seeds as well as seed corn throughout Europe. Ewart remarks that "although the seeds do not appear to have a very prolonged vitality, they are able to resist the action of fermenting manure for some months without losing the power of germination," while passage through the stomach of an animal usually favours germination.

Seedlings.—Cleavers is a very hardy annual, and the seeds germinate quite late in the year. At the moment of writing (the last week of November) seedlings may be found in thousands in all stages along the hedgerows. In the first stage (Fig. 3, *b*) the seedling is observed to be strong and sturdy, with fibrous roots, and stout smooth hypocotyl, which is whitish below to brownish-green tinged with red above. The cotyledons (Fig. 3, *b'*) are nearly oblong, markedly incurved at the apex, with a short broad petiole about one-third the length of the lamina and scarcely distinct from it; they are smooth, and about $\frac{2}{5}$ to $\frac{1}{2}$ in. (10 to 12 mm.) long by $\frac{1}{4}$ to $\frac{1}{3}$ in. (6 to 8 mm.) broad without the petiole.

The cotyledons enlarge as the seedling grows, and in the second stage (Fig. 3, *c*) may be $\frac{2}{3}$ in. (16 mm.) long by $\frac{3}{8}$ in. (9 mm.) broad. There are signs of branching from the base; the stem is four-angled and bears stout hooked hairs turned downwards, enabling the weed to climb. The leaves and leaf-like stipules are rather variable, but are four to six in a whorl, and broadly lanceolate to lanceolate or nearly round-oval, narrowing towards the base, while they are densely hairy and rough, and bear a short spine at the apex.

The still older seedling (Fig. 3, *d*) is much like the stage already described, but the cotyledons may now be up to $\frac{7}{8}$ in. (21 mm.) long by $\frac{3}{5}$ in. (15 mm.) broad, the petiole being $\frac{1}{3}$ in. (8 mm.) long. This stage is strikingly like the mature

plant, and the seedling can hardly be mistaken after the stage shown in Fig. 3, *b* is passed.

Mature Plant.—Cleavers grows rapidly from the seed, which germinates in late autumn, early winter, or early spring, the flowering stage being reached by or before June and continuing through the summer. The mature plant (Fig. 3, *e*) is long and straggling, and much branched. The four-angled stems are provided with inverted hooks to enable the plant to climb; the leaves and stipules are narrow and lanceolate, $\frac{1}{2}$ to 2 ins. long, with a spine at the apex, and in whorls of six to eight; the small flowers (Fig. 3, *e'*) are white, and occur in small clusters springing from the leaf axils. The fruits are described above.

Prevention and Remedy.—Pure seeds must be sown, particularly red clover, Italian rye-grass, and seed corn. The fruits may occur plentifully in farmyard manure, and care should be taken to destroy the germinating power of all weed seeds before giving them to stock. Percival states * that "In some of the worst cases we have seen the weed was brought to the farm by dung containing the seeds." Surface cultivation during early spring and summer, and again in late autumn, encourages the seeds to germinate, when the seedlings may be destroyed by the harrows or in autumn by ploughing under. The hoe should be kept busy throughout the summer, and in bad cases removal by hand may be useful, though this method is of necessity difficult. Holdich says, "How to destroy this weed is how to destroy all annuals, namely, by encouraging the seeds to vegetate and killing them with the plough."

LADY'S MANTLE.

Field Lady's Mantle (*Alchemilla arvensis,* Lamk.), also known as Parsley Piert or Parsley Break-stone, is a little annual which may sometimes prove too plentiful in cornfields, particularly perhaps on dry, loamy, and calcareous soils. Pitt † terms it "a diminutive weed of small account, but sometimes too much abounding."

* *Agricultural Botany*, J. Percival, 1910, p. 594.

† "On the Subject of Weeding; or the Improvements to be effected in Agriculture by the Extirpation of Weeds," William Pitt: Communications to the Board of Agriculture, Vol. v., 1806.

Fruits.—The fruits (Fig. 4, *a*) occur one to three together, the seeds being enclosed in the calyx-tube. They are about $\frac{1}{12}$ in. long by $\frac{1}{15}$ in. broad (2 mm. long by 1·7 mm. broad), light brown in colour, rough and hairy, somewhat streaked owing to shrinkage of the calyx, and compressed, so lying on one of the two broad sides; they terminate in eight teeth, four large and four small, the remnants of the calyx and epicalyx—the eight teeth, however, are seldom clearly visible.

Seedlings.—When the seedling first appears it is very minute; the first stage shown (Fig. 4, *b*) has a brownish fibrous root, and a slender, smooth, colourless hypocotyl tinged with red. The cotyledons are very small, at first forming a kind of sheath at the base, inclined to the same side, petiolate, roundish and slightly incurved at the apex, green above and whitish below. The petiole is flat and broad, and about $\frac{1}{12}$ in. (2 mm.) long, while the blade is $\frac{1}{15}$ to $\frac{1}{12}$ in. (1·7 to 2 mm.) in diameter.

The second stage (Fig. 4, *c*) shows that the first leaves are radical, trifid and lobed, hairy above and at the margins, green above and whitish beneath, and petiolate, the petiole being channelled above and with a broad wing on the lower part. In this stage the under-surface of the cotyledons and the stalks of the leaves may be slightly tinged with pink.

Subsequent stages (Fig. 4, *d*) closely resemble the second stage, the leaves being trifid and lobed, dark green and hairy above, whitish beneath, and with a dark vein running to the apex of each lobe or tooth.

Mature Plant.—The flowering plant (Fig. 4, *e*) is about 4 to 9 ins. in height, prostrate, hairy, with small fan-like trifid leaves which clasp the stem like an inverted mantle. The minute flowers (Fig. 4, *e'*) bear no petals, and are green; they are in crowded clusters in the axils of the leaves, and appear between May and August.

Prevention and Remedy.—Field Lady's Mantle is not usually very troublesome, but where it occurs in quantity must be thoroughly hoed out, while surface cultivation in spring will aid in reducing it. The root crop following a cereal will keep it down, and it is unlikely to be plentiful in a good "take" of "seeds."

Peat-Moss Litter Manure.

The supply of farmyard manure for use in the Royal Botanic Gardens, Kew, is obtained in the neighbourhood from contractors, 'bus proprietors, and others who keep a number of horses. For some years a considerable proportion of the manure thus obtained has been made with peat-moss litter, imported, it is believed, from Denmark, and composed chiefly of compressed dead moss and bog peat, as it has been formed in marshes, &c. It is neither peat nor moss as these are understood in horticulture, and is entirely unsuited for the growth of plants. It is imported in the form of bales which are broken up in the stables to be spread as bedding in the stalls. When it becomes saturated with urine and contains a considerable proportion of horse droppings, it is thrown into a heap to be carted away. Compared with straw-made manure this moss-litter manure is cheap, but it is not looked upon with favour by market gardeners. Its use at Kew has been mainly as a top dressing for lawns and borders, but only after it has been exposed to the air for about six months, and turned several times. It has not been used for mixing with the soil, but this spring some of the flower-beds were in error manured with it. Its effect on the health and growth of the plants which were afterwards put into these beds for the summer was markedly deleterious. The plants not only failed to start into growth, but many of them weakened and died, and as this was evidently due to the manure in the soil in which the plants were set, samples of the soil and manure were submitted to Dr. J. A. Voelcker for analysis and report.

Dr. Voelcker's report was as follows:—

"I have now completed my examination of the sample of Soil and that of Peat-Moss Manure which you sent me.

"The analysis of the Peat-Moss Manure is as follows:—

Moisture	39·59
Organic matter and salts of ammonia ...	46·87
Oxide of iron and alumina, with traces of phosphoric acid	1·49
Lime	0·90
Alkalies, magnesia, &c.	4·81
Insoluble siliceous matter	6·34
	100·00

"The organic matter and salts of ammonia contained 2·11 per cent. nitrogen, equal to 2·56 of ammonia. It was further found that of matters soluble in water the manure contained nitric acid, 0·01; sulphuric acid, 0·33; and chlorine, 0·09 per cent.

"The manure was distinctly acid in reaction, and showed:—

Acidity reckoned as acetic acid ... 0·88 per cent.

"Of the soil a water extract was made, and this gave:—

Total matters soluble in water ... 0·098 per cent.

"Of this 0·046 per cent. consisted of organic matter, and 0·052 per cent. of mineral matter, this latter being mostly sulphate of lime. There was only a trace of chlorine in it, but a marked quantity of nitrates was present.

"In the examination of the manure and soil alike there was not detected anything leading to the belief that disinfectants, deodorisers, &c., had been used with the manure.

"To come next to anything that may possibly have caused the losses experienced with the plants in consequence of using the manure in question—it does not appear, from my examination, that any mineral acid or the like has been used with the manure, nor do I think that any disinfectant, such as carbolic acid, has been employed with the manure. Yet the evidence you have kindly collected and put at my disposal does undoubtedly tend to show that ill results have followed the use of this particular manure. I have, therefore, carefully considered the matter from the light of practical experience and supplemented this with such facts as the analyses have brought out.

"Undoubtedly there is a strong prejudice among gardeners, and market gardeners in particular, against the use of farmyard manure made with peat-moss litter. To what that prejudice is due I have not been able exactly to find out. But there remains the fact that market gardeners will not use this manure until it has been kept stored for a considerable time—say quite two years. After that time it is reckoned safe to use. You inform me that the manure in question was not absolutely fresh, but had been kept some time, though, it would appear, nothing like the two years mentioned.

"I have come to the conclusion—from my examination—that the ill effects in the present case are due to the marked

acidity of the manure, this acidity being due to organic acids in the manure and not to mineral ones. I find in the soil (in which the manure has been used) iron compounds present in the ferrous—or not fully oxidised—condition, and it would seem to me likely that these are the result of the liberal use of an organically-acid body such as the peat-moss, and that an unhealthy, imperfectly oxidised condition of the soil has been brought about.

"Very probably if the manure be kept longer and allowed to rot more thoroughly, it becomes more aerated and oxidised, and then would not show the ill effects noticed.

"This, it seems to me, is a possible explanation of what has occurred in the present case, and it is the explanation, at least, which would suggest itself to me."

For the purpose of comparison the following analysis of farmyard manure is taken from the article on Manures in the new edition of the *Encyclopædia Britannica*, written by Dr. Voelcker. "Farmyard manure consists of the solid and liquid excreta of animals mixed with the material used as litter. Its composition varies according to the conditions under which it is produced. The principal determining factors are: (1) the nature and age of the animals producing it; (2) the food that is given them; (3) the kind and quantity of litter used; (4) whether it be made in feeding boxes, covered yards, or open yards; (5) the length of time and the way in which it has been stored.

"This analysis represents the general composition of well-made farmyard manure in which the litter used is straw:—

Water	75·42
*Organic matter	16·52
Oxide of iron and alumina	0·36
Lime	2·28
Magnesia	0·14
Potash	0·48
Soda	0·08
†Phosphoric acid	0·44
Sulphuric acid	0·12
Chlorine	0·02
Carbonic acid, &c.	1·38
Silica	2·76
	100·00."

* Containing nitrogen = 0·59 per cent. which is equal to ammonia 0·72 per cent.

† Equal to phosphate of lime 0·96.

Cultivation of Furze for Fodder and for Seed in France.

Furze or gorse (*Ulex europæus*) is cultivated for fodder in many districts in France, and is often used to replace clover and lucerne in seasons when green fodder is not available. It is readily eaten by horses and dairy cattle, and cows are said to do as well on it as on good meadow hay.

Before being fed to stock, the stiff spiny branches must be crushed or softened. A hand machine is used for this purpose in France, by means of which the stems are crushed between two cylinders, and then cut by knives into pieces of about two inches in length. The stems are also crushed by hand with a mallet, in a wooden or stone trough, when no machine is available. The necessity for treatment in this way constitutes the most serious objection to the use of furze as a feeding-stuff.

Two varieties of furze are grown in France, the ordinary thorny furze (Ajonc de Dinan) and an improved or thornless variety, known as foxtail furze (Ajonc queue de renard).

Districts where cultivated.—Furze is cultivated principally in the Department of Côtes du Nord, where the plant is much valued, and where an area of 15,000 acres is under this crop. In Morbihan there is an area of about 1,250 acres under regular cultivation, and an equal area on hedges and ditches. The plant is also grown in the Departments of Dordogne, Mayenne, Loir-et-Cher, Finistere, Loire Inférieure, and Ille-et-Vilaine. In Mayenne it is only found at the summits of a few hills, and mixed with heather. It is used with this latter plant as litter, and does not seem to be cultivated either for fodder or seed. In Loir-et-Cher furze is only used to form hedges, and in Loire Inférieure it grows spontaneously on several soils without being the object of any special care. In Ille-et-Vilaine there are a few agriculturists with regular plantations.

On hedges and in ditches the unimproved or thorny furze is, as a rule, the only variety grown, while where regular fields (*ajonières*) are kept under cultivation, the variety is frequently the improved or foxtail variety. The improved variety, without prickles, is much easier to harvest, but where the cultivators possess suitable implements for breaking the furze, this variety is not in great demand.

Seeding is carried out in the spring, at the rate of about 18 lb. per acre. The plant is cultivated in rows of about a yard in width, running from north to south, in order that the plants may derive the greatest possible benefit from light and air. The plant grows vigorously without any attention, and may last on the same plantation for ten years.

The first cutting for fodder is carried out in the second winter after sowing, in November, December, January, and February. From March onwards the furze is bitter, and is not readily eaten by stock. Where cultivation is carried on for seed, it is stated that growers alternate the production for fodder and for seed, as production of seed is considered exhausting for a furze plantation.

The sale of the seed is of importance in some districts, and the following information, obtained by the French Ministry of Agriculture, and forwarded to the Board through the Foreign Office, will be of interest in connection with this subject.

In no case is the cultivation of furze for seed carried on as the sole means of livelihood, as the seed can only be harvested biennially; at least eighteen months after cutting or five months after flowering must elapse before harvesting of the seeds can take place. If a crop is cut during the winter as forage it will not flower until the end of the following winter, the flowering period being from January to April. In the western districts of the Department of Côtes-du-Nord complete maturity of the seed occurs at the end of June and during the first fortnight of July. In Morbihan the seed is harvested on plants of two years.

Harvesting.—Although not complicated, harvesting operations require to be attended with several precautions. The fruit is a dehiscent pod, which opens violently at complete maturity (above all if the weather is dry), and the seeds are scattered in all directions; thus, if harvesting is left too late there is a loss of seed, and only those pods which are not so mature can be gathered. The plantation must be carefully watched, and cutting undertaken when the pods have a brown tint, this being a sign of approaching maturity. In Morbihan the majority of cultivators wait until the first pods are ripe, and even until a certain number have opened from advanced maturity.

Furze seed on hedges and uncultivated lands is gathered by hand by poor country people in many districts, and handed over by them to small rural merchants, who resell to merchants in the large towns. Even where the furze is regularly cultivated, some cultivators prefer to harvest by hand, but the method is slow, and is only possible when an abundant supply of cheap labour is available, and when the price of seed is high.

The stems of furze are cut as near as possible to the pods. When cut by hand, the thorny stems of the plant are raised by a small wooden fork, with two or three prongs, held in the left hand, and the part bearing the pod is cut by a sickle held in the right hand. The lower parts of the stems are taken away later as fuel.

To avoid the dehiscence of the ripest pods, cutting is recommended when the plants are slightly wet, *i.e.*, in the morning or evening, or after a little rain.

Preparation for market.—The pods are carried to the farm and placed on cloths and sacks, or on the barn floor, where they burst open under the action of drying, the seeds being thrown out of the pods and easily gathered. At least a month is necessary for exposure to air and light before the greater part of the seeds can be gathered. If the pods are exposed during drying to too hot sunshine, the quality of the seed will be injured through too early maturity.

The seeds are cleaned by being passed through a winnowing machine. This machine separates the heavy seeds from the light seeds coming from adventitious plants and from impurities, such as husk. Cleaning is also carried out by means of a sieve, with conveniently-sized holes. No other preparation is made before marketing. Purchases are made by rural seed merchants who are directly in touch with the cultivators. Furze seed, if kept in suitable storage, retains its germinative faculty for five or six years.

Yield.—The unimproved variety of furze, growing on hedges and in ditches, is much more productive of seed than the foxtail variety, but seed from the latter is larger in size if care has been taken to thin out the plants.

An acre of ordinary furze yields, on an average, 180 lb. to 270 lb. of seeds, while foxtail gives about 90 lb. to 135 lb. of seeds per acre. A bushel of seed weighs about 56 lb.

Prices.—The prices of furze seed have sensibly risen for several years past. In Côtes-du-Nord the prices for foxtail during the last two or three years have been as follows: maximum price, 1s. 6d. to 1s. 8d. per lb., minimum price, 1s. 2d. per lb.; and the price for ordinary seed has been about 9d. to 11½d. per lb. Higher prices than these, however, seem to have been realised during 1911 in some Departments. In Morbihan 1s. 6d. per lb. is stated to have been obtained for common seed, and 3s. 4d. per lb. for foxtail. As much as 3s. 8d. per lb. is said to have been paid in Dordogne.

Ergot.

This well-known parasitic fungus (*Claviceps purpurea*, Tul.) is of economic interest from two distinct standpoints, viz., its baneful influence on plant and animal life respectively. The great mortality that at one time existed amongst the inhabitants of certain parts of France and other countries where rye, contaminated with ergot, constituted the staple food, is now, fortunately, to a great extent a thing of the past, owing to the fact that the subject has been thoroughly investigated. This has led to the almost total eradication of ergot from our cereal crops. On the other hand, ergot is exceedingly abundant on many wild grasses in this country, and undoubtedly proves highly injurious to cattle. This idea has long been entertained by farmers in this country, but the subject has been most exhaustively investigated in the United States. A serious epidemic of cattle, at first considered to be "foot-and-mouth disease," was proved to be caused by ergotised food. Abortion also frequently occurs when cattle graze in pastures where ergot is abundant.

The first stage of the fungus appears in the form of blackish, horn-like bodies projecting from the inflorescence of cereals and various grasses. The myriads of minute reproductive bodies produced on these black sclerotia are conveyed by insects to the flowers of other grasses, which in turn become infected. During the autumn these black bodies, or sclerotia, fall to the ground, and remain in an unchanged condition until the following spring, when they produce a second form of fruit, the spores of which are scattered by wind, &c., and infect the flowers of grasses, thus setting up

the stage which results in the production of the black bodies or sclerotia.

Eradication of this pest turns entirely on preventive methods. Keeping grass cut to prevent flowering for two seasons practically eradicates the fungus. Special attention should be paid to wild grasses growing in ditches, hedges, headlands, &c. A goat kept with stock is of service, and has alone in some instances prevented injury to stock, as goats eat ergot without anything but satisfactory results.

Protection of Animals Act, 1911.

The Board of Agriculture and Fisheries are desirous of drawing the attention of agriculturists to certain provisions of the Protection of Animals Act, 1911 (1 and 2 Geo. 5, ch. 27), which consolidates the existing law with considerable amendments. The Act applies to England and Wales, and, with certain modifications, to Ireland, but does not apply to Scotland. It takes effect from January 1st, 1912.

Among the offences of cruelty constituted by the Act, which involve severe penalties on conviction are (1) causing unnecessary suffering to an animal by wantonly or unreasonably doing or omitting to do any act; (2) conveying or carrying an animal in such manner or position as to cause it unnecessary suffering; (3) wilfully and without reasonable cause or excuse administering to an animal any poisonous or injurious drug or substance; and (4) operating on an animal without due care and humanity.

Penalties may also be inflicted on persons who cause or procure any such acts or omissions, and on the owners of animals if they fail to exercise reasonable care and supervision in respect of the protection of the animals therefrom.

The section which deals with these matters does not apply to:—

(*a*) The commission or omission of any act in the course of the destruction, or the preparation for destruction, of any animal as food for mankind, unless such destruction or such preparation was accompanied by the infliction of unnecessary suffering; or

(*b*) The coursing or hunting of any captive animal, unless

such animal is liberated in an injured, mutilated, or exhausted condition; but a captive animal is not considered to be coursed or hunted before it is liberated for the purpose of being coursed or hunted, or after it has been recaptured, or if it is under control.

The section applies not only to domestic animals, but also to any animal which is in captivity or confinement, or which is maimed, pinioned, or subjected to any appliance or contrivance for the purpose of hindering or preventing its escape from captivity or confinement.

In any case of a conviction of an owner for an offence of cruelty to his animal, the court is given the power to direct that the animal shall be destroyed at the expense of the owner if upon the evidence of a duly registered veterinary surgeon it is shown to be cruel to keep the animal alive. If it is shown that the animal would be likely to be exposed to further cruelty if left with its owner, he may be deprived by the court of the ownership of the animal. The owner of an animal may obtain compensation not exceeding ten pounds for the damage or injury caused to his animal by a person convicted of the cruelty which has caused the damage.

Animals in Pounds.—Impounded animals must be fed and watered by the person impounding them under the penalty of a fine; and if impounded animals are left without sufficient suitable food or water for six hours or longer, anybody may enter the pound and feed and water them. In either case the cost of the food or water is recoverable from the owner.

Use of Poisons.—The existing law as to the use of poisons is modified, and under the new Act a person is liable to a penalty if he (*a*) sells, or offers or exposes for sale, or gives away, or causes or procures any person to sell or offer or expose for sale or give away, or knowingly is a party to the sale or offering or exposing for sale or giving away of any grain or seed which has been rendered poisonous except for *bonâ-fide* use in agriculture; or (*b*) knowingly puts or places, or causes or procures any person to put or place, or knowingly is a party to the putting or placing, in or upon any land or building any poison, or any fluid or edible matter (not being sown seed or grain) which has been rendered poisonous.

In any proceedings under paragraph (*b*) it is a defence that the poison was placed by the accused for the purpose of destroying rats, mice, or other small vermin, and that he took all reasonable precautions to prevent access thereto of dogs, cats, fowls, or other domestic animals.

This provision is, in its application to Ireland, modified by Section 17 (2) of the Act.

Spring Traps.—Any person who sets, or causes or procures to be set, any spring trap for the purpose of catching any hare or rabbit, or which is so placed as to be likely to catch any hare or rabbit is liable to a penalty if he does not inspect, or cause some competent person to inspect, the trap at reasonable intervals of time, and at least once every day between sunrise and sunset.

Societies for Marketing Fruit in Ontario.*

Associations of fruit-growers in Ontario are mainly of three kinds, viz.: Societies for sending apples to markets (generally distant markets), societies for marketing fruit generally and small fruit associations engaged mainly in forwarding small fruit to home markets.

Societies for Marketing Apples.—Of the three kinds of societies these are the least well organised, but the system adopted by one or two of these associations may be of interest. In the case of one society there is no share capital, and the deposits of buyers are depended on for working capital. A shed is rented for storing the apples; buyers are required to pay a certain proportion of the price before the apples are forwarded, and the remainder of the price within a certain time. The society then pays to each member a certain price per barrel of apples, reserving a little more than sufficient to pay expenses. At the annual meeting of the society the amount in hand is paid back to the growers according to the business done by them. The only person who is paid—beside the necessary employees—is the secretary-manager, who receives a commission on the fruit sold.

In another case the members have formed themselves into

* U.S. Daily Consular and Trade Reports, October 10th, 1911.

a joint stock company, owning a central packing-house at which the fruit of all members is packed, a charge being made for each barrel of apples packed. The revenue so obtained forms a fund out of which expenses and a dividend on the stock are paid. In this case sales are made largely by consignment.

General Fruit Associations.—One of the oldest of these general fruit associations is remarkable for the simplicity of its organisation, in that it has no constitution or by-laws, no warehouse, and no capital in any form, there being only a verbal agreement between the members. Each grower packs his own fruit, and sends it to market under his own name, and on its individual merits. Consignments are, however, arranged by a manager, who directs growers when to deliver fruit, pays over to each grower the price realised by his consignment, and attends to various small matters.

A large society which was organised in 1896 has a mechanical cold-storage plant valued at £2,600, and a working capital of £400. A part of the capital was secured by mortgage on the property, no dividends being paid until the mortgage was cleared off. The sales of the society amount to £15,000 worth of fruit annually, business being done for non-members as well as members. This association, in addition to marketing fruit, supplies its members with seeds, fertilisers, spraying apparatus, and materials, &c.

Small Fruit Associations.—These societies forward small fruit to local markets. In one case which is typical the society is incorporated without share capital; it buys fruit from the members, helps to secure a good market, and disseminates information among the members.

Federation of Fruit Associations.—In 1906, thirteen societies became affiliated under the name of the Co-operative Fruit Growers of Ontario, with the object of improving the quality of fruit, keeping the associations in touch with the prices offered at various markets, and securing a more uniform distribution of the crops. Reports are obtained of the conditions in the various fruit-producing districts of Canada, and during the season notes on the condition of the markets, the quality of the fruit being consigned, the prices, and other matters of interest, are sent to each society in a weekly report.

A meeting of the federation is held in the autumn of each year to fix a range of prices as a basis of sales. The federation also purchases supplies of spraying materials, machinery, &c., for the individual societies, very large savings in the price paid being made in this direction.

Grading and Packing.—Where grading and packing are done by individual members, the only satisfactory method of sale is for each member's fruit to be disposed of on its individual merits. In some cases a system of inspection of the grading and packing is undertaken by the society, but this method lacks uniformity.

Two methods of packing and grading by the society itself are adopted. In one case uniformity is ensured by the fruit being packed and graded in the society's warehouse by its own packers. In the other case, the fruit is packed and graded in the orchard by the society's packers. The latter method relieves the grower of much work at a busy time of the year.

Determination of Prices to be Paid to Growers.—The method originally adopted was to distribute returns to members on the basis of the amount of fruit sent to market without consideration as to varieties, but this was found to encourage the production of poor varieties, and a method which has been largely adopted is to divide the varieties of fruit of a certain kind into classes, those varieties of nearly equal quality being placed in the same class. The price is then pooled on each grade of each class. In a third method separate account is kept of each grade and each variety, and the price is pooled on each variety and grade. Pooling is necessary, as one consignment may not sell so well as another.

Production of Sulphate of Ammonia.

The report of the Chief Inspector of Alkali Works for 1910 (*H.C.* 187, 1911), shows that there were 543 works or separate processes for the manufacture of sulphate or muriate of ammonia in England and Wales, as compared with 536 in 1909 and 526 in 1908, the number having steadily increased from 449 in 1904. In Scotland the number of such works was 104. There were also 57 gas liquor works in England and five in Scotland.

Sulphate of ammonia is chiefly obtained as a bye-product from coal. When this is treated for the production of coal-gas or for the manufacture of coke used in iron smelting, an "ammoniacal liquor" results, which forms the raw material for the manufacture of ammonium salts. The distillation of the bituminous shales used in the Scotch paraffin industry also yields a certain amount, and the ammonia produced in other manufactures in which coal and similar substances are used, in iron works, from producer gas plants, and from carbonising works, is also collected. The quantity of sulphate of ammonia produced in the United Kingdom is shown in the following table:—

Source.	1910.	1909.	1908.
	tons.	tons.	tons.
Gas works	167,820	164,276	165,218
Iron works	20,139	20,228	18,131
Shale works	59,113	57,048	53,628
Coke-oven works	92,665	82,886	64,227
Producer-gas and carbonising works (bone and coal)	27,850	24,705	24,024
Total	367,587	349,143	325,228

These figures show an increase over the production of 1909, with the exception of iron works, which remained practically stationary. The supply from coke ovens shows an increase of nearly 10,000 tons. In 1904 the production in coke-oven works was only 20,000 tons. The total production in 1910 was 368,000 tons, and 284,000 tons were exported, so that the balance remaining for home consumption for all purposes amounted to 84,000 tons, as compared with 85,000 tons in 1909 and 91,000 tons in 1908. The exports of sulphate of ammonia are principally to the United States, Japan, Spain, Java, and Italy.

An expansion of ammonia production is anticipated, owing to the further erection of recovery plants connected with the manufacture of coke and fuel gas. Recent improvements in design of sulphate of ammonia plant suitable even for small gasworks is likely to add to the total of sulphate of ammonia production by enabling many small or inconveniently

situated works to produce sulphate more economically than heretofore, whilst the recovery of this substance from peat continues to receive energetic attention, and may prove a further source of production.

In the table below are shown the imports of the materials used in the fertiliser trade, the principal being mineral phosphates. A proportion of the nitrate of soda imported is used in the manufacture of sulphuric and nitric acid.

	1910.	1909.	1908.
	tons.	tons.	tons.
Guano	20,395	20,321	34,417
Mineral phosphates	455,593	451,807	529,135
Nitrate of soda	126,498	90,207	145,724

The figures show a considerable increase compared with 1909 in the quantity of nitrate of soda, Peruvian guano and mineral phosphates remaining the same.

The number of chemical manure works under inspection in 1910 was 161, as compared with 167 in 1907. In Scotland the chemical manure works numbered 38, or the same number as in 1909.

Committee on the British Export Trade in Live Stock.

The Report * of the Departmental Committee appointed by the President of the Board of Agriculture and Fisheries to inquire and report as to the British export trade in live stock with the Colonies and other countries, has been recently issued. The Report deals with the character and extent of the existing trade; and with the possibility of extending it by advertising, by affording facilities to the foreign buyer in this country, and by the establishment of a Government testing station. It also discusses the various hindrances which affect the trade, such as tuberculosis and other diseases, foreign import regulations, transit rates and facilities, export certificates and insurance.

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* Cd 5947. Price 5*d*. (Wyman).

The following are the recommendations made by the Committee :—

(1) The export of inferior or unsuitable pedigree stock should be discouraged.

(2) In the appointment of consuls to certain districts a knowledge of British live stock should be taken into consideration.

(3) The Intelligence Division of the Board of Agriculture and Fisheries should be enlarged so as to provide a "Bureau of Information" for increasing the facilities as regards the export of pedigree stock.

(4) The official volume entitled, "British Breeds of Live Stock" should be supplied to British consuls and presented to representative agricultural bodies in certain countries.

(5) Official encouragement and assistance should be given to the system of keeping milk records.

(6) It is desirable that, in the case of countries where exporters of British livestock find difficulties to exist in connection with the tuberculin and other tests, the Government of each country concerned should in the first place be invited to appoint an official in this country for the purpose of testing animals before exportation, as the American and Australian Governments have already done. In the event of any Government declining to adopt this proposal, steps should be taken to ascertain whether the authorities concerned would recognise a certificate issued at a Government testing station in this country, and the Committee recommends that an official testing station (or stations) should be established accordingly, if the exportation of live stock now or in the future would seem to justify the capital and annual expenditure necessary.

(7) There should be no relaxation of the existing live stock import regulations which tend to prevent the introduction of contagious animal diseases into this country.

(8) Official assistance should be given for research work as regards the prevention and cure of contagious animal diseases.

(9) If the existing law is insufficient it should be strengthened in order to penalise a person who treats an animal so as to falsify, or with intent to falsify, the result of a test by

inoculation or otherwise which is required by a statute or regulation or otherwise, or with intent to defraud, causes any test to give a false result.

(10) The attention of veterinary institutions which grant diplomas in this country should be drawn to the importance of providing thorough instruction in the application of the tuberculin test.

(11) The law should be strengthened, if necessary, in order to penalise a person who obtains by false pretences a certificate of registration of an animal, or who fraudulently uses any such certificates.

(12) Exporters should consider whether they would prefer any reasonable alternative to the present system of charging for the carriage of live stock by passenger train, forwarding their agreed suggestions to the railway companies either directly or through the Board of Agriculture and Fisheries.

(13) Exporters should (*a*) consider the rates charged for single animals sent by goods train; and (*b*) ascertain whether stock is conveyed by the shortest route, and whether the charges are based on the shortest route; and should, if necessary, communicate with the railway companies,, either directly or through the Board of Agriculture and Fisheries.

(14) The Board of Agriculture and Fisheries should request the Breed Societies to draw the attention of their members to the fact that the Board are prepared to investigate complaints as to excessive railway charges or insufficient facilities.

(15) Official action should be taken against Shipping Combines when necessary to prevent any prejudicial effect on the export of live stock owing to the system of deferred rebate.

(16) It is desirable that the Governments of certain countries which import British live stock should be approached with the view of securing their acceptance of official export certificates issued by the Board of Agriculture and Fisheries.

As regards recommendation (6), relating to the establishment of an official testing station, Mr. T. H. Middleton, one of the members of the Committee, suggests a modification of the terms of this recommendation as follows:—

"An official testing station for applying the tuberculin test and for immunising pedigree stock against certain diseases

would be likely to prove of much value in promoting and developing the export trade. A station of this kind should in the first place be established as an experimental measure; it is probable that after a few years it would become self-supporting, and it might then be established on a permanent basis."

In support of this recommendation, Mr. Middleton points out that, were satisfactory arrangements made for testing cattle in Britain, there is substantial reason to expect that the test would be generally accepted in South Africa, and in view of the considerable export of cattle which has recently taken place from this country to South Africa, and the stringent regulations as to quarantine, it is clearly desirable in the interests of exporters that an endeavour should be made to prevent a repetition of such hindrances to trade as exist in the Buenos Aires quarantine station. The immunisation of stock against certain diseases might remove an obstacle to the development of a trade with Brazil, Venezuela, and other sub-tropical countries, since it is now possible to protect cattle from attacks of redwater by means of a vaccine; and it may in the future be possible to immunise stock against other diseases prevalent in the country for which they are destined.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURING.

Continuous Growing of Wheat and Barley (*Rept. on the Woburn Field Expts., Jour. Roy. Agric. Soc., Vol.* 71, 1910).—Wheat and barley have been continuously grown at Woburn since 1876 on the same land, the manures being applied every year.

In 1910 the yields of wheat generally were well up to the average of the ten years 1897–1906. The unmanured plots gave 14·1 bush. per acre; mineral manures alone gave rather less, viz., 12·6 bush.; the produce from farmyard manure was only 18·1 bush., but rape dust gave 25·1 bush. The highest yield of wheat was 27·8 bush., from mineral manures with nitrate of soda, the latter manure being applied in alternate years (last applied in 1909). A plot on which mineral manures and sulphate of ammonia were used and which received a dressing of one ton of lime in January, 1905, gave a yield of 24·1 bush. The influence of lime in one case was clearly marked for quite thirteen years. As regards quality, the wheats as a whole were poor; the best

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

were the unmanured, minerals only, and rape dust plots, the worst the nitrate of soda and sulphate of ammonia plots. Phosphate appeared to be slightly better than potash in a mixture of manures.

The barley crop generally was very poor and considerably below the average. The unmanured plots gave only 3·5 bush., the lowest produce for many years; mineral manures did better, viz., 8·4 bush., but this plot had a great deal of weed; farmyard manure yielded 17 bush., but in contrast to wheat, rape dust produced only 11·7 bush. of barley. The highest yield was 31·5 bush., from a heavy dressing of nitrate of soda with minerals; the omission of nitrate of soda for a single year reduced the yield to 15·3 bush. As a whole, the nitrate of soda plots did better than corresponding sulphate of ammonia plots even where lime had been applied with the latter. The limed plots, along with sulphate of ammonia, showed the lime to be practically worked out after thirteen years, although, along with mineral manures in addition, its effect was still noticeable. Potash appeared to be better than phosphate in a mixture of manures. The quality of the barley was generally better than that of the wheat.

Rotation Experiments (*Rept. on the Woburn Field Expts., Jour. Roy. Agric. Soc., Vol.* 71, 1910).—This experiment is now concluded, and a summary of the results will be made by Dr. Voelcker.

Soil Surveys and Soil Analysis (*Jour. of Agric. Science, Vol. IV., Part* 2, *October,* 1911).—Messrs. Hall and Russell, of Rothamsted, contribute an article to this publication on soil surveys and soil analysis. A soil survey of the counties of Kent, Surrey, and Sussex, carried out by the authors, was recently published by this Board, and the article under notice is devoted to the scientific aspects of the work. The authors point out that the chemist has great difficulties in interpreting a soil analysis in the absence of comparative figures from similar soils in the neighbourhood, and advocate the extension of soil surveys to the remaining counties of the kingdom. The article under notice contains a full description of the methods adopted in the survey of the south-eastern counties undertaken by them, and will prove of great use to investigators contemplating similar work elsewhere. Stated briefly, the objects of a soil survey are (1) to show the distribution of soils of similar agricultural properties and to define these soils in terms of their composition and properties; (2) to ascertain the relationship between the composition of soils and their known agricultural qualities; and (3) to guide agriculturists in the selection of soils appropriate for particular purposes.

The authors show how the results obtained by them fulfil these objects by discussing their analyses in the light of the information given them by farmers regarding the agricultural properties of the soils to which they relate. The investigations, it should be noticed, were not confined to purely chemical analyses. The authors lay great stress on the value of mechanical analyses of soils, by which is meant analyses based on the size and number of the soil particles irrespective of their chemical composition. For example, they find that the typical fruit soils are alike in containing 60 per cent. of "fine sand" and "silt," and 12 per cent. of "clay." (For the purposes of this work, such terms as "fine sand," "silt," &c., have been given a definite meaning. Fine sand, for example, is defined as consisting

of particles between 0·2 and 0·4 millimetre in diameter, "silt" as particles between 0·04 and 0·01 millimetre, and so on.) The authors go on to point out that such analyses alone do not provide sufficient criteria of the economic value of soils; they must be considered in the light of such important factors as the amount of organic matter and calcium carbonate present in the soil, and, above all, the condition of the soil in regard to water supply and retention of moisture must be taken into consideration. Climatic conditions, and, finally, the chemical analysis, also influence the interpretation of the results.

The point of most interest to the practical agriculturist in this paper is the minor position given to purely chemical considerations. In a review of an article by one of the authors in last month's *Journal* (p. 653) mention was made of the views of the Bureau of Soils, U.S.A., in regard to this question, and it was pointed out that still less consideration is given in America to the chemical analysis of soils. In the present paper the main defects of chemical analysis are stated to be that "it does not aim at finding out the actual composition of the soil . . . it does not deal with the whole of the soil, but only with the less resistant portions . . . the methods are arbitrary." On the other hand, the advantages of mechanical analysis are that it "gives a complete picture . . . it accounts for many of the peculiarities observed in cultivation." Its disadvantages are that it is restricted in its application, inasmuch as it cannot be used for chalk and peat soils (such as the fen soils), being most useful for mineral soils, *i.e.*, the sands, loams, and clays which form the greater portion of the agricultural soils of this country.

Formation of Calcium Carbonate in the Soil (*Jour. of Agric. Science, Vol. IV., No. 2, October,* 1911).—In this paper Mr. C. T. Gimingham gives an account of his investigations on the formation of calcium carbonate in the soil by bacteria. A supply of this substance is indispensable for the maintenance of fertility, and as it is constantly being removed by various processes connected with the nutrition of plants, it is necessary to explain why many soils maintain their fertility though chalk or lime has not been artificially supplied. The author has succeeded in isolating a number of bacteria which have the power of manufacturing carbonate of lime from a common constituent of plant tissues, namely, oxalate of lime, a salt which in its chemical constitution is not far removed from carbonate of lime.

Manuring of Meadow Land (*Field Expts. in Staffordshire and Shropshire, and at the Harper Adams Agric. Coll., Rept.,* 1910).—These experiments were started in 1903 in conformity with a scheme of the Agricultural Education Association, and the results for eight years are given in this report.

The field was laid down many years ago, the soil being a stiff clay loam resting upon a bed of clay overlying the red sandstone. A dressing of 1½ cwt. nitrate of soda, 2½ cwt. superphosphate, and ½ cwt. sulphate of potash per acre gave in eight years a yield of 15 tons 11 cwt. of hay per acre, or 6 tons 7½ cwt. of hay more than the unmanured plot; valuing the hay at 50*s.* per ton makes the profit due to the use of this dressing in eight years £6 19*s.* The effect of omitting sulphate of potash was slightly to reduce the yield and the profit, while when superphosphate was left out a loss resulted compared with the un-

manured plot. Omitting nitrate of soda decreased the yield, but so slightly that the profit from the use of sulphate of potash and superphosphate was greater than that from the complete dressing. The results on plots where the three manures were used singly confirmed the conclusion that the principal requirement of the soil was phosphates. Ten tons of dung applied in 1903 and 1907 without other manuring produced a yield in eight years of 13 tons 6 cwt. of hay, with a net profit of £5 9s. Where, in addition to the dung, the complete dressing of artificials was given in the years between 1903 and 1907 and after 1907, a yield of 16 tons 8 cwt. of hay was obtained—the highest during the experiment—with a net profit of £6 7s. It will be seen that this is less profitable than the complete dressing of artificials in every year.

An experiment was commenced in 1909 to ascertain the effect of potassic superphosphate compared with superphosphate and kainit together, but no definite conclusions can as yet be drawn from it.

Manuring of Barley (*Field Expts. in Staffordshire and Shropshire and at the Harper Adams Agric. Coll., Rept.*, 1910).—Potassic superphosphate was compared with a mixture of potash and superphosphate in 1909 and 1910 for barley, the soil being a medium loam, very suitable for the crop. A dressing of kainit, superphosphate, and sulphate of ammonia proved very slightly superior to a dressing of potassic superphosphate and sulphate of ammonia having the same composition as the former dressing. The yields from potassic superphosphate and superphosphate having the same money value were almost identical. As regards the nitrogenous manure to be used along with potassic superphosphate, sulphate of ammonia proved best in 1909, and nitrate of soda in 1910, the difference between these two manures and nitrate of lime in 1910 being hardly noticeable.

Manuring of Mangolds (*Field Expts. in Staffordshire and Shropshire and at the Harper Adams Agric. Coll., Rept.*, 1910).—A series of trials upon the value of top dressings in conjunction with a complete manuring for the mangold crop was continued in 1910. The highest average result was obtained by the combined use of nitrate of soda and superphosphate as a top dressing. Superphosphate as a top dressing in combination with other manures gave somewhat variable results. Applied as a top dressing with farmyard manure, superphosphate gave a profitable return, either alone, or with 1 cwt. nitrate of soda. Nitrate of lime gave, on the whole, better results than nitrate of soda as a top dressing.

Various compound manures were tested for the mangold crop in 1909 and 1910. The composition of these manures and the resulting crops are given in the report.

Potassic superphosphate, basic slag, and superphosphate were compared as manures for mangolds in 1908, 1909, and 1910, with results, on the average, in favour of basic slag.

Manuring of Grass Land (*Experiments at Kineton, Warwick*, 1911).—The land on which this experiment is conducted by Mr. Ernest Parke had at the start been laid down in grass for about ten years, and was in very poor condition owing to neglect of manuring. Artificial manures have been used every year since 1901, and the results on the hay crop during the subsequent ten years are considered in this report

by Dr. Bernard Dyer. The average crops in this time are shown in the following tables: —

UPPER HALE FIELD.

	Cwt. per Acre.
No manure	13
5 cwt. basic slag	33½
5 cwt. basic slag, 1 cwt. sulphate of potash	35½
5 cwt. basic slag, 1½ cwt. nitrate of soda	42½
5 cwt. basic slag, 1½ cwt. nitrate of soda, 1 cwt. sulphate of potash ...	43
1½ cwt. nitrate of soda	33

FIVE AND THREE ACRES FIELD.

No manure	10½
3 cwt. superphosphate	30½
3 cwt. superphosphate, 1 cwt. sulphate of potash	31½
3 cwt. superphosphate, 1½ cwt. nitrate of soda	39
3 cwt. superphosphate, 1½ cwt. nitrate of soda, 1 cwt. sulphate of potash	40
1½ cwt. nitrate of soda	30

The quantities of manures were slightly different in the first two or three years. It will be seen that phosphates have produced a large increase, while potash salts have had but small effect. This is in accordance with an analysis of the soil of the fields made at the beginning of the experiment, which showed it to be very poor in available phosphoric acid, but sufficiently provided with potash. The best herbage, in which clovers and grasses flourish with equal vigour and luxuriance, is found on the plots on which phosphates and nitrates are used. On these an annual dressing of 5 cwt. of basic slag, or 3 cwt. of superphosphate, with 1½ cwt. of nitrate of soda, has given an annual gain of 30 cwt. of hay.

Manuring of Swedes (*Field Expts. in Staffordshire and Shropshire and at the Harper Adams Agric. Coll., Rept.*, 1910).—Trials have now been carried out for six years on the comparative values of nitrogenous manures for the swede crop. Money value has been made the basis of comparison, and the experiments have extended over a variety of soils and in seasons of varying character. The standard dressing given each year has included steamed bones, 4 cwt., superphosphate, 3 cwt., and kainit, 2 cwt. The amount of nitrogenous dressing applied has varied slightly with the price of the manure; 1 cwt. sulphate of ammonia has been taken as the basis, and equivalent money values of the other manures have been applied. The average results of a series of years and from the various soils show that there is but small variation in the return from the different nitrogenous dressings.

The standard dressing of 3 cwt. superphosphate, 2 cwt. kainit, 4 cwt. steamed bones, and 1 cwt. sulphate of ammonia has also been compared with a dressing in which the superphosphate and kainit were replaced by 397 lb. potassic superphosphate, the two dressings having the same cost. The average results over three years were 21 tons 18 cwt. per acre of swedes from the potassic superphosphate, and 22 tons from the superphosphate and kainit.

From 1907–10 a comparison was made of the phosphatic manures usually applied to swedes, the amounts of each used being such that their money values were equal. High-grade basic slag and steamed bones were found to be slightly inferior to low-grade basic slag with nitrate of soda, bone meal, or dissolved bones.

Basic slag and superphosphate were compared as manures for swedes in respect of the feeding value of the roots, half-acre plots being treated with these two manures on an equal money value basis. The roots were fed off by 60 sheep (30 on each plot), the increases in live weight being noted, and the sheep were sold in the market. The animals from the superphosphate plot gained 2 qr. more in weight than those from the basic slag plot, and realised 1*s.* 10½*d.* more per cwt., so that the results were in favour of superphosphate.

Various compound manures of different manufacturers for swedes were tested in 1909 and 1910. The composition of the manures and the yields in 1909 and 1910 are given in the report.

Manuring of Potatoes (*Monmouthshire Agric. Educ. Com., Potato Trials,* 1910).—The manurial trials were carried out at two centres with a number of different varieties, the point tested being the effect of artificials. It is considered that the experiments go to show that the flavour, quality, and keeping properties of potatoes grown without artificial manure are better, though the bulk obtained is smaller, than with artificials.

FIELD CROPS.

Varieties of Potatoes (*Monmouthshire Agric. Educ. Com., Potato Trials,* 1910).—A large number of varieties were tried, Scotch, Irish, and English seed being used, and the crops, together with the result of a cooking trial of each variety, are given.

Varieties of Wheat (*Bedfordshire C.C. Agric. Educ. Com., Rept. on Wheat and Oat Plots,* 1911).—Fifteen varieties of wheat were grown in 1911 on a well-drained, heavy clay soil. The crops per acre this year and the average crops for the five previous years are shown in the following table:—

	Average yield for five years previous to 1911. Bushels.	Yield 1911. Bushels.
Kinver Red (Webb)	43	31
Square Head Master	41½	34
White Stand Up (Carter)	41	33
Red Stand Up (Carter)	40	35
Red Standard (Webb)	40	33
Blue Chaff Rivetts (Percival, Reading College)	Not grown	39
Burgoyne's Fife (Camb. Univ.)	,,	35
Little Joss (Camb. Univ.)	,,	35
Red Fife (Canadian)	32	13

It is concluded that on heavy clay land it is advisable to grow a red in preference to a white variety. Red Fife was by far the best sample of wheat, but does not yield well enough. Little Joss, a new Cambridge wheat, was one of the best samples after Red Fife.

WEEDS AND PLANT PESTS.

The Action of Carbon Dioxide on Bordeaux Mixtures (*C. T. Gimingham, Jour. Agric. Science, Vol. iv., No. 1, May, 1911: Cambridge University Press*).—Mr. Pickering has shown that when carbon dioxide is passed through Bordeaux mixture the basic sulphates contained in it are decomposed with the formation of copper sulphate. To the soluble copper sulphate liberated in this way he attributes the main fungicidal action of Bordeaux mixtures.

In the investigation described in this paper, however, Mr. Gimingham found that the whole of the copper thus brought into solution by the action of CO_2 for a short time was reprecipitated in an insoluble form on the removal of the CO_2 by allowing the liquid to stand exposed to the air or by passing air through it. It appears therefore that though copper sulphate is formed by the action of CO_2 on Bordeaux mixture, it is immediately changed into basic copper carbonate, which is only soluble in the presence of CO_2. This, though quite consistent with Pickering's work, is difficult to reconcile with the view that atmospheric carbon dioxide is the important factor in bringing into play the fungicidal properties of Bordeaux mixtures. To test this under more practical conditions, Bordeaux mixture was allowed to stand in a shallow layer exposed to the air, or had a current of air drawn through it, for long periods, but though a portion of the copper could be changed into the carbonate by atmospheric carbon dioxide, no more than a trace was kept in solution. The conclusion drawn from these experiments is that, although the action of carbon dioxide in excess on the compounds present in Bordeaux mixtures brings copper into solution, yet it does not appear that sufficient copper is held in solution by carbon dioxide derived from the atmosphere to be of importance as a fungicide. It is difficult to apply experimental results directly to practical conditions, because we have no accurate knowledge of the state of affairs in a film of dew or rain on the surface of a leaf; possibly traces of carbonate of copper are present in solution under some conditions, but that there should ever be enough carbon dioxide to dissolve more than very minute amounts seems most unlikely.

The Fungicidal Action of Bordeaux Mixtures (*B. T. P. Barker and C. T. Gimingham, Jour. Agric. Science, Vol. iv., No. 1, May, 1911: Cambridge University Press*).—The problem of the manner in which Bordeaux mixture exerts a fungicidal action, apart from its physiological effect on plants, is generally accepted to be equivalent to the question of how the copper, which is present in an insoluble form, is rendered soluble.

A purely chemical explanation—that copper is brought into solution by the action of the carbon dioxide of the air—has been rejected by one of these authors in the paper noticed above. Two other theories have been advanced, viz., that either the leaves, or the fungus itself, convert some of the copper into the soluble form by which the fungus is poisoned. The supposition that excretions from the leaves exert a solvent action was examined by some experiments, in which jars containing distilled water and Bordeaux mixture precipitate were fixed round growing shoots of fruit trees. In all cases but one, using

Bordeaux mixture without excess of lime, the leaves brought some copper into solution. Care was taken to choose uninjured shoots, but it is very difficult to find leaves quite free from small injuries. The small amount of copper dissolved by exudations from these small injuries increases the injuries, and these then proceed to dissolve more copper. Experiments with single leaves supported this view, and though the results are inconclusive as to the power of uninjured leaves to exert a slight solvent action, the authors are inclined to attribute the action rather to such injuries to the foliage.

The question of the existence of a solvent action of the fungus itself upon Bordeaux precipitates has hitherto not been settled. In this investigation hanging drop cultures of spores were made with Bordeaux mixture and with the filtrate from it. In the filtrate germination and subsequent growth were fairly vigorous, while in the drops of the Bordeaux mixture germination was rare. Diffusion tubes were then used to separate Bordeaux precipitate from its filtrate, when the spores germinated both in the filtrate outside the diffusion tubes and in the diffusion tubes containing the precipitate, but in the latter case only at a little distance from the precipitate itself. In the final experiments films of Bordeaux precipitate were allowed to dry on cover-slips, and films of *Nectria* conidia were superimposed on these films, overlapping them. After 24 hours in a moist atmosphere there was a sharp limit between dead and living conidia which coincided practically exactly with the edge of the copper film. Beyond the copper zone nearly all the conidia were living, and had germinated in many cases, especially in the region farthest removed from the copper. From these results it is concluded that there is a solvent action on the part of the fungus, which is, however, not strong enough to produce serious toxic effect except when direct contact with particles of the insoluble copper compound occurs. The action is purely local and cannot result in the bringing into solution of sufficient copper to exercise a general fungicidal action over the whole surface of a leaf. Some spores, *e.g. Puccinia* spores, which have a thick resistant coat, may be uninjured by contact with the copper compound, and growth will apparently be possible if the germ tube escapes contact. As far as practical considerations are concerned, this work would support the conclusions arrived at by fruit-growers, viz., the necessity for thorough spraying, so as to coat as completely as possible the surfaces liable to infection, the importance of the finely divided form of the copper precipitate, and of the adhesive properties of the spray. It explains also how Bordeaux mixture may be effective immediately after application.

Silver-Leaf Disease (*Jour. of Agric. Science, Vol. IV., No. 2, October,* 1911).—In a paper on Silver-Leaf Disease, Mr. F. T. Brooks gives an account of investigations carried out by him at Cambridge with reference to this disease. The results confirm the conclusions of Prof. Percival and Mr. Pickering (summarised in this *Journal,* vol. xviii., p. 38) that the disease is caused by the fungus *Stereum purpureum.* The author succeeded in producing the disease in healthy plum-trees by inoculating with the spores of the fungus. He is of opinion that the disease is probably communicated in this way from diseased to healthy trees. Mr. Brooks's investigations have been aided by grants from the Development Fund.

Destruction of Hedge Mustard (*Biedermann's Zentralblatt für Agrikulturchemie, October,* 1911).—Calcium cyanamide, sulphate of iron, and three patent preparations, were compared as to their relative effectiveness in destroying hedge mustard which had strongly infested a field of oats.

Sulphate of iron was found to be the most effective material as well as the cheapest. The quantity used for spraying was 53 gallons per acre of a 22 per cent. solution. Calcium cyanamide was strewn over the field at the rate of 80, 90, and 180 lb. per acre, the best results being given by the largest quantity.

HORTICULTURE.

Varieties and Pruning of Apples (*Warwickshire C.C. Educ. Com., Fruit Plot, No.* 1, *Ann. Rept.,* 1909–10).—Thirty-six varieties of apples have been grown on the plot, and the crops of each in the four years 1906–9 are classified under the headings, "very heavy," "heavy," &c. The pruning experiments are considered to have shown sufficiently clear results to indicate the most suitable methods of dealing with numerous varieties, when grown as bush trees on the Broad-leaved Paradise stock, and directions are given for six methods of pruning found most suitable for certain groups of varieties.

MISCELLANEOUS.

Effect of Atmospheric Impurities upon Vegetation near an Industrial Town (*Charles Crowther and A. G. Ruston, Jour. Agric. Science, vol iv., Pt.* 1, *May,* 1911 : *Cambridge University Press*).—This investigation comprises a three-years' series of analyses of rain collected at Garforth, a twelve-months' series of analyses of rain collected in Leeds, and researches into the effect of atmospheric impurities upon vegetation. An extensive series of analyses of rain falling at Rothamsted has already been published, and these results are probably typical of the essentially rural parts of the country, fairly remote from the sea. The Garforth farm, however, is situated six miles from Leeds, in the neighbourhood of coalfields, and the results obtained there may probably be taken as applicable to the large tracts of agricultural land situated in the smoke-infested localities so extensive in area in many parts of the country. The Leeds samples were collected at ten different stations, ranging from markedly industrial to purely residential suburban districts. The following table shows in pounds per acre per annum the dissolved impurities in the Garforth rain and in that of the station in Leeds which had on the whole the most impure rain, and the Rothamsted results are added for comparison :—

	Nitrogen.	Sulphur.	Chlorine.	Free acid.
Rothamsted	3·84	17·41	14·87	—
Garforth	8·37	95·7	20·89	20
Leeds (Station 2)	15·5	215·0	198·0	90

The nitrogen includes that brought down as nitrates and nitrites, and not that in the form of organic matter, which amounted in addition, to 1·56 lb. per acre at Garforth, 2·9 lb. at the Leeds station, and 4·7 lb. at another station in Leeds. Estimations were also made of the suspended matters (ash, tar, and soot) in Leeds rain, and the amount varied at the different stations from 90 lb. to 1,886 lb. per acre. The investigators observe that the outstanding feature of the

Garforth results is the relatively high amounts of each of the impurities. The results bear unmistakable evidence of the fact that the impurities have their origin largely in the combustion of coal, this being the most obvious source of the acid which occurs in such appreciable quantities in the rain. Very large areas of such smoke-infested agricultural land are to be found in the north.

The second part of the investigation was concerned with the effect on plant growth and the soil of the state of the atmosphere thus ascertained. The intensity of the daylight throughout the day was measured at six stations in Leeds, and was found to vary regularly in inverse ratio to the amount of suspended matter in the air, the effect being so considerable that at a station in the industrial part of the city the average intensity was 40 per cent. less than at a suburban station. These suspended impurities also check vegetation by settling on the leaves, and thus shutting out further light, and clogging the stomatal openings. The assimilatory powers for carbon dioxide of laurel leaves gathered in different parts of the city were measured, with the result that if the rate of assimilation be represented by 100 in leaves from the suburban station with the purest air, at the other stations it varied down to only $11\frac{1}{2}$. As regards the dissolved impurities brought down in rain, detrimental action is probably confined to the free acid and the lower sulphur compounds (SO_2, H_2S, &c.), as there is no reason to believe that the nitrogenous impurities and perhaps the chlorides and sulphates, will be other than beneficial. An experiment with timothy grass showed the effect of the application of acidulated water to the soil. Boxes of the grass, sown in 1908, were watered at the rate of the average Garforth rainfall with water containing from one to thirty-two parts per 100,000 of sulphuric acid, and with Garforth rain water, neutralised Garforth rain, and Leeds rain. The weights and composition of the material grown each year were ascertained. In every case the yield steadily decreased with increased acidity of the water, and by 1910 the grass watered with the water containing sixteen and thirty-two parts of acid was dead. Analysis of the grass showed that the nitrogen content was reduced, and the content of crude fibre increased by the acid. This inferiority in nutritive value was quite evident even in the case of the grass watered with water containing only one part of acid per 100,000, a proportion that is about the average in Garforth rain, and it becomes of importance to ascertain to what extent such deterioration can be traced on a large scale in the meadows of smoke-infested regions. Chemical analysis of the soil, which had been used in these grass experiments for three years, showed a distinct correlation between the amount of acid applied and the constituents of the soil except in respect to total nitrogen. Increasing acidity led, on the one hand, to diminished content of nitrates and carbonates, and to diminished absorptive power for oxygen, but on the other hand to increased content of the easily soluble mineral ingredients and ammonia. The bacterial flora of the soil was strikingly influenced by the acid, the total number of bacteria diminishing rapidly with increasing acidity, this being reflected also in diminished activity as regards ammonia production, nitrogen fixation, and, above all, nitrification. The greater check to the nitrifying than to the ammonia-producing organisms

explains the increased ammonia content of the treated soils noted above.

It is clear from this investigation that the atmosphere in and around a large industrial city such as Leeds is relatively highly charged with impurities, many of which exert a marked deleterious effect upon plant growth. The impurities are most abundant in the industrial quarters of the city, but are disseminated over very large areas, especially in the directions of the prevailing winds.

OFFICIAL NOTICES AND CIRCULARS.

Regulations and Awards, Show of Thoroughbred Stallions, 1912.

The Regulations for the show of thoroughbred stallions suitable for breeding half-bred horses, to be held at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement Society, on March 12th, 13th, and 14th, 1912, have recently been issued by the Board, and give particulars of the King's Challenge Champion Cup, King's Premiums, and Super-Premiums, to be awarded at the show.

PARTICULARS OF AWARDS.

King's Champion Challenge Cup.—His Majesty the King has been graciously pleased to offer for competition a cup for the Champion Stallion in the Show, to which a King's Premium is awarded, to be selected from amongst the stallions recommended for Super-Premiums. The cup will be held by the winner for one year only, and shall then be returned to the Board of Agriculture and Fisheries. A gold medal will also be awarded by the Board of Agriculture and Fisheries to the owner of the Champion Stallion.

King's Premiums.—Fifty King's Premiums are offered by the Board of Agriculture and Fisheries for Thoroughbred Stallions not under four nor over twenty years old.

The average value of a Premium is £176 5*s.*, paid by the Board, as follows:—

	£	*s.*	*d.*
Premium of 100 guineas—half paid at the time of award and the other half after the close of the service season	105	0	0
Service fee of £1 1*s.* a mare (average number, 50), paid after the close of the service season ...	52	10	0
Foal fee of 12*s.* 6*d.* a foal (average number, 30), paid after the close of the foaling season ...	18	15	0
	176	5	0
In addition, a service fee of £2 a mare (average number, 50) is chargeable to the owner	100	0	0
Average earnings	276	5	0

Fees are paid by the Board in respect of (but not exceeding) 90 mares, and the earnings of a stallion serving that number would be approximately £410.

Super-Premiums.—Super-Premiums of the value of 100 guineas, paid at the time of award, will, in addition to the ordinary Premium,

be given to selected stallions of exceptional merit. Not more than 10 will be awarded in 1912. The owner of a stallion is required to state on the entry form whether he enters his stallion for competition for a Super-Premium. If he does so enter it, he is to sign an undertaking agreeing to exhibit the stallion (if awarded a Super-Premium in 1912) at the Show of Premium Stallions in 1913 in a class for which it is eligible in accordance with the Regulations of the Board.

If he fails so to exhibit the stallion he is to forfeit and pay to the Board the value of the Super-Premium, *i.e.*, One Hundred Guineas.

Entries and Awards.—Exhibitors may enter any number of stallions in each class, and may take *all* Premiums awarded to them.

The last day for entry is Monday, January 29th, 1912, and for post entry, Monday, February 5th, 1912.

Every stallion must be registered under the Board's Registration Scheme before it can be accepted for entry.

Registration of Stallions.

The Board of Agriculture and Fisheries are prepared to entertain applications for the registration of stallions of any recognised breed. No charge is made for registration unless the service fee exceeds £10.

The Board issue a certificate certifying the soundness and suitability for breeding purposes of every stallion accepted by them for registration.

No application can be entertained in respect of a stallion under three years of age or of a stallion which has not been entered or accepted for entry in the recognised stud-book of its breed.

The Hunters' Improvement Society, the Polo and Riding Pony Society, the Shire Horse Society, the Hackney Horse Society, and the Suffolk Horse Society, have arranged to publish in their respective stud-books a list of stallions registered by the Board, and the two first-named societies have also decided to exempt stallions registered by the Board from veterinary examination at their shows.

The acceptance of a stallion for entry at the Spring Show of Thoroughbred Stallions held at the Agricultural Hall, Islington, is conditional upon its having been registered by the Board. Applications for the registration of such stallions must be made before the 1st January next.

The registration year now terminates on October 31st in each year.

Forms of application for registration and copies of the regulations applicable thereto, can be obtained free of charge from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

Research Scholarships in Agricultural Science.

The Board of Agriculture and Fisheries have awarded Research Scholarships in Agricultural Science to the following gentlemen:—

P. G. Bailey, B.A. (Camb.); J. Clayton, B.A. (Camb.); J. T. Edwards, M.R.C.V.S.; E. T. Halnan, B.A. (Camb.); J. Hammond, B.A. (Camb.); J. A. Hanley, A.R.C.S.; G. E. Johnson, M.Sc. (Birm.); C. G. P. Laidlaw, B.A. (Camb.); A. E. Lechmere, M.Sc. (Bristol); J. W. Lesley, B.A. (Camb.); A. Neville, B.Sc. (Lond.), F.I.C., F.C.S.; G. T. Spinks, B.A. (Camb.).

These scholarships have been established in connection with the scheme for the promotion of scientific research in agriculture, for the

purposes of which the Treasury have sanctioned a grant to the Board from the Development Fund. The scholarships, which are of the annual value of £150, and are tenable for three years, have been established in order to train promising students, under suitable supervision, with a view to their contributing to the development of agriculture, either by carrying out independent research, or by acting in an advisory capacity to agriculturists.

Departmental Committee on Foot-and-Mouth Disease.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to inquire into the circumstances of the recent outbreaks of foot-and-mouth disease, and to consider whether any further measures can be adopted to prevent their recurrence.

The Committee will be constituted as follows: The Right Hon. Sir Ailwyn Fellowes, K.C.V.O. (Chairman); Sir Charles D. Rose, Bart., M.P.; Sir Harry Verney, Bart., M.P.; Sir J. Bowen Bowen-Jones, Bart.; Mr. Charles Bathurst, M.P.; Mr. William Field, M.P.; Mr. John Hinds, M.P.; Mr. George R. Lane-Fox, M.P.; Mr. Richardson Carr; Major E. M. Dunne; Mr. E. E. Morrison; Mr. E. P. Nunneley.

Mr. W. H. F. Landon, of the Board of Agriculture and Fisheries, will act as Secretary.

Foot-and-Mouth Disease.

The Board of Agriculture and Fisheries have withdrawn, as from December 8th, all the restrictions which were imposed by them on the movement of animals in connection with the recent outbreaks of Foot-and-Mouth Disease on premises near Bridgwater, Somerset.

The existence of Foot-and-Mouth Disease amongst cattle at Halfway Farm, Tintinhull, Matlock, Somerset, was confirmed on 7th inst., twelve animals having been found to be affected with the disease.

The usual precautions have been taken to prevent the spread of the disease, and an Order has been issued prohibiting the movement of animals in a large area surrounding the affected farm.

MISCELLANEOUS NOTES.

Notes on Agriculture Abroad.

Beef Supplies in the United States.—From a report received from the Foreign Office, it appears, according to the *National Provisioner*, that the beef prospect is a dubious one. Good cattle are exceedingly scare, and high in price, but coarser beasts have been very plentiful, and have been a drag upon the market. Cattle-feeding will be at a minimum this winter, and there is an apparent shortage of cattle in the country. Regular feeders will be busy, but those who, taking advantage of the cost of feeding stuffs and the state of the market, occasionally feed, are likely to abstain. The shortage of hay, and the temptation to sell corn, instead of feeding it, are given as reasons.

Heavy market receipts of Western cattle indicate the further depletion of feeder supplies. Should beef production suddenly become popu-

lar, there is not the basis to work upon, as the cattle are not in the country or on the feed lots. It will take at least two years to replenish stock and get going again, even if high prices this winter stimulate a resumption of beef production.

Importation of British Pedigree Bulls into the Gold Coast.—In the Report on the Northern Territories of the Gold Coast for 1910 (*Colonial Reports, Annual,* No. 683) it is stated that an attempt was made in 1909 to introduce English bulls with a view to improving the local breed of cattle. The animals were Aberdeen Angus bulls, but were not suitable to the country, and though they left England in good condition did not live to reach the Northern Territories of the Gold Coast. Three more bulls have, however, been ordered from England, and throughout the journey will be under the charge of a veterinary surgeon who has selected breeds more suitable to the country.

Notes on the Weather in November.

The weather during the *first* week in November (October 29th to November 4th) was in a very unsettled and stormy condition over the whole of Great Britain. Rain fell daily over a large area, some of the amounts being very heavy. The fall over the whole week was either "heavy" or "very heavy," except in England N.E. Temperature was "unusual" in two districts, viz., England N.E. and the Midland Counties, but "moderate" elsewhere. Bright sunshine was less than the normal over the western parts of the country, but more in the eastern districts.

Conditions were again unsettled throughout the *second* week. Rain was frequent, and occasionally very heavy, but fair, bright intervals were not uncommon; only in England N.E. was the rainfall below the normal; the excess above the normal in England S.E. and the English Channel was very large. Temperature was below the average in all districts, but the amount of bright sunshine was above the average to a considerable extent in some English districts.

Dull and unsettled weather prevailed again in the *third* week. Over a large portion of Great Britain rain was experienced daily, some of the amounts being very large. Sleet and snow were common in the north and east of Scotland late in the week. Taking the week as a whole the rainfall was "very heavy" in England E. and Scotland E., and, with the exception of the Midland Counties, "heavy" elsewhere. Temperature was above the normal in all districts except Scotland N.; in England E. the excess was as much as 4·6°, 6° being recorded early in the week. Bright sunshine was either "moderate" or "scanty."

Precipitation, frequently in the form of snow, sleet, or hail, occurred on several days of the *fourth* week in the eastern and northern parts of Great Britain; elsewhere, however, very light falls of rain were recorded, the deficit from the average being generally very large. The temperature over the country was "deficient," except in the Midland Counties. The amount of sunshine recorded varied, being above the average in the western section, and below or about equal to the average in the eastern section of Great Britain.

Produce of Potato and Root Crops.

The following preliminary statement shows the estimated total produce and yield per acre, of the potato and root crops in Great Britain in the year 1911, with comparisons for 1910, and the average yield per acre of the ten years 1901–10 :—

Crops.		Estimated Total Produce.		Acreage.		Average Estimated Yield Per Acre.		Average of the ten years. 1901–1910.
		1911.	1910.	1911.	1910.	1911.	1910.	
		Tons.	Tons.	Acres.	Acres.	Tons.	Tons.	Tons.
Potatoes	England ...	2,674,790	2,467,179	402,512	376,834	6·65	6·55	6·06
	Wales	180,246	131,660	26,667	26,013	6·76	5·06	5·06
	Scotland ...	975,182	878,300	142,629	136,837	6·84	6·42	6·39
	Great Britain	3,830,218	3,477,139	571,808	539,684	6·70	6·44	6·08
Turnips and Swedes.	England ...	9,317,159	16,531,832	1,066,678	1,064,404	8·73	15·53	13·53
	Wales	828,874	1,000,613	57,947	58,494	14·30	17·11	15·60
	Scotland ...	6,251,569	8,162,573	438,816	442,447	14·25	18·45	16·37
	Great Britain	16,397,602	25,695,018	1,563,441	1,565,345	10·49	16·41	14·40
Mangold	England ...	7,245,046	9,105,471	438,855	429,457	16·51	1·20	20·11
	Wales	191,322	205,468	11,154	11,057	17·15	8·58	17·96
	Scotland ...	43,209	42,056	2,252	2,265	19·19	18·57	17·76
	Great Britain	7,479,577	9,352,995	452,261	442,779	16·54	21·12	20·04

NOTE.—The yield per acre of potatoes is slightly larger than in 1910, while the total production, owing to an increase of more than 30,000 acres, is some 350,000 tons more than in 1910. Turnips and swedes have yielded only 10½ tons per acre in Great Britain, the Scottish returns being much better than the English, and little more than two tons below the average, whereas in England the deficiency is nearly 5 tons. The total of nearly 16½ million tons represents a shortage of about 6½ million tons as compared with the average of the past 10 years, and the crop is the smallest since 1899. Mangolds are returned at 3½ tons per acre below the 10 years' average, being the lowest yield since 1896, while the total of under 7½ million tons is the smallest since 1903, in which year there were, however, 50,000 fewer acres under the crop than at present.

The preliminary statement of the produce and yield per acre of the corn, pulse, and hay crops was issued on the 3rd inst., and that of the produce and yield of hops on October 12th last.

Crop Conditions in Great Britain on December 1st.

The Crop Reporters of the Board, in reporting on the crops and the agricultural conditions on December 1st, state that November, on the whole, proved favourable to autumn work, which is now generally well forward. In certain localities the heavy rainfall had hindered operations to some extent, but in these good progress had generally been already made in October, while the strong clay lands had practically

everywhere been rendered workable during the month, so that in very few districts was the autumn work behindhand.

As a consequence, the bulk of the wheat—about 80 per cent.—had been got into the ground by December 1st. In the east of England probably about 85 per cent. had been sown, and about 75 or 80 per cent. in the other parts of England. As compared with the same date last year, the area sown appears to be about 5 per cent. greater, the increase (in England) being perhaps the greatest in the south-west and least in the south-east, while the great corn-growing districts of the east were about 7 per cent. higher than on December 1st, 1910. In Scotland the area sown was perhaps 10 per cent. less than at the same date last year.

The condition of the young wheat seemed everywhere satisfactory, both as regards healthiness and general growth.

Mangolds had practically all been lifted, and stored in good condition; the quality is very generally good. The roots are nearly everywhere small in size. The recently published preliminary returns showed that mangolds have yielded 16½ tons per acre this year, the total production of under 7½ million tons being nearly 2,000,000 less than in 1910, and the smallest total since 1903. Turnips and swedes are very generally poor or bad in quality, and in many cases are not expected to keep well. Large areas are, of course, being, as is usual, fed off on the ground, and in some districts this practice is being extended this year, partly because the turnips are often not worth lifting, and partly because the roots were still growing, especially in the north. The total production is estimated at 16,400,000 tons (10½ tons per acre only), or no less than 9,300,000 tons less than in 1910; the Scottish returns being much better than the English. The yield of potatoes was above the average by ⅝ of a ton per acre, the 6·7 tons per acre representing a total production of 3,830,000 tons, or some 350,000 tons more than in 1910.

Notes on Crop Prospects Abroad.

The *Bulletin of Agricultural Statistics* for November, 1911, issued by the International Institute of Agriculture, shows the production of the cereal crops this year from information received up to November 15th. The countries for which it is possible to give an approximate estimate of the production of wheat, rye, barley, and oats are as follows:—In Europe: Prussia, Belgium, Denmark, Spain, France, Great Britain, Ireland, Hungary (including Croatia and Slavonia), Italy, Luxemburg, Netherlands, Roumania, Russia in Europe (63 governments), Switzerland; in America: Canada and United States; in Asia: India, Japan, Russia in Asia (10 governments); in Africa: Algeria, Egypt, Tunis. The principal alterations are in the production of wheat and rye in Russia in Europe, referred to below.

Wheat.—The production of wheat in Russia in Europe is now estimated to be 68,462,000 qr., a decrease of 759,000 qr. on the estimate given in the previous Bulletin. The total production for all the countries this month is 386,488,000 qr., as compared with 385,818,000 qr.

in 1910, or an increase of 0·2 per cent.; while the total area harvested exceeds that of last year by 3·3 per cent.

Rye.—The production of rye in Russia in Europe is now estimated to be 86,592,000 qr., a decrease of 5,071,000 qr. on the estimate in the previous Bulletin. The total production of rye in all the countries specified (excluding Great Britain, India, Japan, Egypt, and Tunis) is 154,517,000 qr., as compared with 165,361,000 qr. last year, or a decrease of 6.6 per cent. The area harvested is greater than that of 1910 by 1·9 per cent.

Barley.—The total production in the above-named countries, with the exception of India, is estimated to be 145,002,000 qr., as against 145,825,000 qr. last year, or a decline of 0·6 per cent. The area harvested nearly equals that of 1910.

Oats.—The total production in the countries specified above, excluding India and Egypt, is now estimated to be 347,203,000 qr., as compared with 382,365,000 qr. last year, a decrease of 9·2 per cent. The area harvested is very slightly less than in 1910.

Maize.—The estimated preliminary figures for Spain, Hungary, Italy, Roumania, Russian Empire, Switzerland, Canada, United States, Algeria, and Tunis place the production at 378,579,000 qr., as compared with 425,095,000 qr. last year, which is a decrease of 10·9 per cent.

Sugar-beet.—The official figures of production in Prussia, Belgium, Denmark, Hungary, Roumania, Russia, and Servia give a total output of 22,445,000 tons, as compared with 29,028,000 tons last year, a decrease of 22·7 per cent., although the area under the crop this year exceeds that harvested in 1910 by 11·1 per cent. The greatest decrease has taken place in Prussia, where the yield is only 5,139,000 tons, against 10,424,000 tons last year.

The following supplementary notes are given:—

Argentina.—The final returns of the area under wheat are 17,036,000 acres, oats, 2,547,000 acres, and rye, 37,000 acres.

Chile.—The areas sown to wheat and barley are 1,852,000 acres and 370,000 acres respectively. The estimated yield of wheat is 21 bush. per acre, and of barley 41 bush. per acre. The condition of wheat and barley is good.

Australia.—The area under wheat for the crop year 1911–12 is 7,902,000 acres, as compared with 7,207,000 acres last year; the condition of the crop on November 1st was average. The area under oats is 689,000 acres.

New Zealand.—The condition of wheat and oats on November 1st was average, and of barley 20 per cent. above average.

Austria.—The condition of winter wheat is 2·4; winter rye, 2·2; sugar-beet, 3·6; clover, 3·6; meadow land, 2·8; and pasture, 3·1. The final estimates place the maize and potato crops at 3·3 (1=very good, 2=above average, 3=average, 4=below average, 5=very poor). (*Deutscher Reichsanzeiger,* November 28th.)

Germany.—The official results of the harvest of 1911 are given below, with similar figures for 1910 (*Deutscher Reichsanzeiger,* December 2nd):—

	1911. Qrs.	1910. Qrs.
Wheat	18,671,255	17,730,624
Barley	17,411,132	15,995,188
Oats	54,422,560	55,809,066
Rye	49,893,583	48,263,743
	Tons.	Tons.
Potatoes	33,821,782	42,769,796
	Tons of hay.	Tons of hay.
Clover (including "Clover and Grass Mixtures" ...	6,956,833	11,751,705
Lucerne	1,074,274	1,631,569
Permanent Grass for Hay { Irrigated	2,159,089	2,762,914
Permanent Grass for Hay { Other ...	17,495,203	25,033,182

Argentina.—The Buenos Aires *Handels-Zeitung* of November 4th states that the recent rains which extended over the whole agricultural territory have assured a good wheat yield. The condition of the crop at present is excellent. A total yield of about 5,500,000 tons is anticipated. (*Dornbusch,* November 25th.)

Denmark.—According to a preliminary report of the Statistical Office, this year's cereal crop was very satisfactory in yield. Yield and condition of wheat and rye vary considerably in the different districts; the quantity is given as above middling and the condition as much above middling. The yields of barley and oats were also much above average, except on the islands, where they were somewhat smaller. Potatoes had suffered from the drought and field vermin, and crop results were therefore less favourable. The potato crop may still be called an average one, but the yield of sugar-beets is below middling, though excellent in quality. (*Dornbusch,* November 30th.)

Canada.—The following report on crop conditions in the first week of November has been issued by the Ontario Department of Agriculture. *Fall Wheat:* The quality of this grain ranges from fair to good, with occasional reports of the sample being light in weight. The average yield per acre, 21·4 bush., is considerably below that of recent years. *Spring Wheat:* Comparatively little now grown in the province. This year's produce is a fairly good crop in every way. *New Fall Wheat:* In the western half of the province, where most of the fall wheat is raised, a slightly increased area has been put in. The bulk of the new seeding found a good bed, and the young wheat was looking well. *Barley:* The crop is practically free from discoloration, but the bulk of the grain is not as plump as usual. The yield, 26·3 bush. per acre, is close to the average. *Oats:* Oats were relatively the poorest of the cereals, as to both yield and quality. The grain is light in weight. The yield per acre is estimated at 31·4 bush. per acre, as against an average yield of 35·5 bush. per acre.

Russia.—From a report received from the Foreign Office the condition of the winter sowings of rye, wheat, and barley up to October 28th is "unsatisfactory" in one government only; "satisfactory or more than satisfactory" in 58 governments; "fairly good" in eight governments, and "good" in seven governments.

United States.—The Crop Reporting Board of the Bureau of Statistics estimates the newly-seeded area of winter wheat to be 0·9 per cent. larger than the revised area sown in the fall of 1910, this being

equivalent to a total acreage of 32,213,000 acres. The condition of winter wheat on December 1st was 86·6, as compared with 82·5 in 1910, and 89·9 the mean of the December averages for the past ten years. The newly seeded area of rye is estimated as being 0·9 per cent. larger than the revised area sown in the fall of 1910, or 2,436,000 acres altogether. The condition of rye on December 1st was 93·3, as compared with 92·6 in 1910, and a ten-year average of 92·9. (*Dornbusch*, December 7th.)

Potatoes on the Continent.—The estimated production of potatoes in *France*, as published in the *Journal Officiel* of November 25th is 11,343,000 tons, as compared with 8,271,000 tons last year. From reports received from the Foreign Office the potato crop in the district of Nantes is inferior as regards quantity to that of 1910, but very superior as regards quality. The crop was harvested in favourable dry weather, and is expected to keep well. In the district of St. Brieuc all potatoes are sound and plentiful, and there is a good crop in the Department of Morbihan. In *Belgium*, around Bruges and district, the potato crop has been far in excess of the previous year. The yield has averaged some 14 tons to the acre. In Liége and district the potatoes, though somewhat small, are of excellent quality, and it is estimated that the crop will be considerably larger than last year.

Sugar-beet in France.—The estimated production of sugar-beet in France, as published in the *Journal Officiel* for November 25th, is estimated to be 3,799,000 tons, as compared with 5,089,000 tons in 1910.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on December 1st, 1911, certain diseases of animals existed in the countries specified :—

Austria (*for the period November 15th—22nd*).
Anthrax, Blackleg, Foot-and-Mouth Disease (total of 77,529 Höfe now infected), Glanders and Farcy, Swine Fever, Swine Erysipelas, Sheep Scab, Rabies, Tuberculosis.

Belgium (*for the period October 1st—15th*).
Anthrax, Blackleg, Rabies, Foot-and-Mouth Disease (1,069 "foyers" in 372 "communes").

Bulgaria (*for the period November 6th—14th*).
Anthrax, Glanders and Farcy, Rabies, Sheep-pox, Sheep Scab, Swine-fever.

Denmark (*month of September*).
Anthrax, Foot-and-Mouth Disease (4 cases).

France (*month of September*).
Blackleg, Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine-fever, Swine Erysipelas, Foot-and-Mouth Disease (20,729 "étables" in 3,124 "communes").

Germany (*for the period November 1st—15th*).
Glanders and Farcy, Swine-fever, Foot-and-Mouth Disease (30,341 infected places in 6,302 parishes).

Holland (*month of October*).

Anthrax, Foot-rot, Swine Erysipelas, Foot-and-Mouth Disease (4,391 outbreaks in 11 provinces).

Hungary (*for the period October 25th—November 1st*).

Anthrax, Glanders and Farcy, Rabies, Swine Erysipelas, Swine-fever, Foot-and-Mouth Disease (total of 25,265 "cours" now infected), Sheep-pox, Sheep-scab.

Italy (*for the period October 16th—22nd*).

Anthrax, Glanders and Farcy, Swine Erysipelas, Swine-fever, Foot-and-Mouth Disease (452 new cases entailing 4,684 animals), Blackleg, Sheep-scab, Rabies.

Montenegro (*for the period October 1st—15th*).

Glanders, Foot-and-Mouth Disease (96 "étables" infected in 13 "communes").

Norway (*month of October*).

Anthrax, Blackleg.

Roumania (*for the period November 4th—13th*).

Glanders and Farcy, Foot-and-Mouth Disease, Pleuro-pneumonia, Rabies, Swine Erysipelas, Swine-fever, Sheep-pox, Anthrax, Blackleg.

Russia (*month of June*).

Anthrax, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine-fever, Foot-and-Mouth Disease (422,045 cases in 5,635 "communes").

Servia (*for the period November 4th—11th*).

Rabies, Sheep-pox, Foot-and-Mouth Disease (185 animals newly infected in 5 "arrondissements").

Spain (*month of September*).

Anthrax, Blackleg, Foot-and-Mouth Disease (19,836 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of October*).

Anthrax, Blackleg, Swine-fever, Foot-and-Mouth Disease (3 "étables").

Switzerland (*for the period November 13th—19th*).

Anthrax, Blackleg, Swine Erysipelas, Foot-and-Mouth Disease (252 "étables" and 2 "alpages-pâturages" entailing 1,215 animals, of which 30 "étables" were declared during the period).

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in November :—

Agricultural Labour in England during November.

Labourers outside the regular farm staff were chiefly required for harvesting the root crops, potato-lifting, threshing, hedging, and ditching. The partial failure of the root crops, and the forward state of farm work generally were the cause of a reduced demand for such men in most districts, and in a number of districts a surplus in the supply was reported. The loss of a little time by extra men, particularly threshers, on account of rain, was reported in many parts of the country.

Northern Counties.—There was only a moderate demand on the whole for extra labourers in these counties. Rain interfered with outdoor work in a number of districts, and employment was also adversely affected by the partial failure of the root crops. Some surplus of extra men was reported in *Cumberland,* the Clitheroe Rural District in *Lancashire,* and the Pickering, Sherburn, and Wetherby Rural Districts in *Yorkshire.* No change in the wages of farm servants was reported at the November hiring fairs in *Northumberland* and *Durham.* Correspondents in *Cumberland* and *Westmorland* reported a downward movement in wages at the Martinmas hirings, on account of the forward state of farm work, the reductions varying from about £1 to £2 for the half-year. Wages were also reported as slightly lower in *Lancashire.* At the *Yorkshire* hirings there was on the whole little change in wages, with, however, a slightly downward tendency.

Midland Counties.—Extra labourers were chiefly required for getting up the root crops and potatoes, threshing, hedging, and ditching. Rain caused some little loss of time in certain districts, and in many cases there was a restricted demand for extra men on account of the poor root crops. The supply of such men was quite sufficient, and there was some surplus in several districts, including the Chesterfield (*Derbyshire*), Tamworth (*Staffordshire*), Upton-on-Severn and Pershore (*Worcestershire*), Banbury and Crowmarsh (*Oxfordshire*), and Watford (*Hertfordshire*) Rural Districts.

Eastern Counties.—Harvesting the root crops, threshing, hedging, and ditching provided a fair amount of employment in many districts for extra labourers. The supply of and demand for men were generally about equal, but in some districts, particularly in *Norfolk* and *Suffolk,* extra men were in somewhat irregular work on account of the failure of the root crops.

Southern and South-Western Counties.—Rain caused some loss of time to extra labourers in *Kent, Surrey,* and *Sussex,* while elsewhere in this group of counties, apart from an occasional interruption to threshing, employment was not generally affected by the weather. The demand for extra men was, however, generally speaking, reduced by the forward state of farm work, and some surplus of men was reported in certain districts in *Hampshire,* and in the Faversham (*Kent*), the Wincanton (*Somerset*), Cirencester (*Gloucestershire*), South Molton

(*Devon*), and Liskeard (*Cornwall*) Rural Districts. A demand for men for tending cattle was reported from the Chippenham (*Wilts*) and Kingsbridge (*Devon*) Rural Districts.

THE CORN MARKETS IN NOVEMBER.

C. KAINS-JACKSON.

After a busy October, November is almost always dull, though on the present occasion it has been perhaps a little less dull than usual. The only staple in the price of which any large modification has occurred is linseed. Of this crop Argentina is expected to have a record yield in January, while the promise of the Indian crop to be reaped in April is also above an average. Putting these two probabilities together, sellers have decided that to tempt business very substantial concessions must be made. The great importance of linseed cake to all who have stock to fatten makes this change in the market for the raw material worth recording.

Wheat.—The price of English has averaged slightly more than in October and September. The total deliveries since September 1st have been 30 to 40 per cent. larger than in the previous two years, but as November wore on the excess became much less noticeable, and we have entered on December with the supply at the local markets not more than an average. The mean value clings closely to 33*s.* per 480 lb.

Imported wheat is nowadays a deeply divided market, the strong sorts, like fine Canadian and American, good Russian, and the best Argentine having their own special buyers, while Australian, Californian, and ordinary Indian and Argentine, are looked up by average purchasers, and inferior Canadian, Russian, and Turkish by those who need the wheat for feeding purposes or for the preparation of certain proprietary articles. Poultry-keepers who find "nothing like wheat" for egg production are rejoicing at the large Canadian consignments of No. 5, No. 6, and feeding Manitoba, which at 34*s.* to 39*s.* per 480 lb., are a decided relief to what had been a very stringent market. Really strong wheat of good quality makes 40*s.* to 41*s.* per qr., good but less special 38*s.* to 39*s.* per qr. Australian has made 37*s.* 6*d.* to 38*s.*, and La Plata 37*s.* to 37*s.* 6*d.*, while Indian has ranged between 35*s.* and 36*s.* for the majority of sorts submitted. New Zealand fetches about 36*s.* for long-berried, and 35*s.* for short-berried. Imports have been somewhat smaller than last season for the period September 1st to November 30th, but the increased supplies from British farmers have prevented there being any dearth of ordinary grades. There were on the 30th 2,640,000 qr. on passage, a total differing in no important degree from the average. Shipments for November were 1,150,000 qr. from North America (including good consignments from Canada); 177,000 qr. from South America; 1,158,000 qr. from Russia; 671,000 qr. from Europe S.E; 417,000 qr. from Australasia; and 246,000 qr. from India. The shipments from Australasia were heavy for the time of year, while with respect to those from Russia the reverse was the case.

Flour.—The average price of Town Household flour has been 26*s.* cash ex mill, against 27*s.* 3*d.* in November, 1910. The difference has not been enough to affect bread prices as a rule. Country Straights

are about 1*s.* lower on the year, 23*s.* 6*d.*, against 24*s.* 6*d.*; but stone-made flour keeps up well in price, and Standard—*i.e.*, 80 per cent. type—is 6*d.* dearer on the month. There is a good sale of fine American wheat ground in the best London mills. This flour is very steady at 28*s.* 6*d.* for cash. American flour has had a wide range, 23*s.* 9*d.* to 24*s.* being accepted for first bakers' type, and 31*s.* 6*d.* paid for fancy north-western spring. A good sample of north-western, such as Pillsbury's Best, can be had for 30*s.* per sack. Canadian best may be put at this level, with 28*s.* 9*d.* to 29*s.* paid for Manitoba straights. The prices of Canadian for January shipment are lower than the spot values. Argentina is promising to ship a good deal of flour in 1912. The best price asked is 27*s.*, and the poorer types come at 23*s.* per sack. The market for Australian has been poor, but there has been some rally in Hungarian, and in Roumanian a fair business, at 32*s.* to 34*s.* per sack, has passed. There were on the 30th 230,000 sacks, a very ordinary quantity, on passage. November shipments were 519,000 sacks from North America.

Barley.—Great firmness has continued to characterise this branch of the market, and some very high averages have been recorded for British markets. There is a rise in the mean value for the month. Californian, on arrival, has been promptly absorbed, and to-day only 35,000 qr. are on passage, while the spot offerings are practically *nil.* Prices naturally favour holders. Some 70,000 qr. of barley are on passage from Mediterranean ports, and will be found serviceable. Russian barley on passage amounts to 315,000 qr., and after a month of almost daily fluctuations, closed well on the holders' side of 6*s.* per cental. A good demand for Indian at 25*s.* to 25*s.* 6*d.* per 400 lb. exists, and the market could take a greatly increased supply of a cereal for which large areas in India are well fitted.

The barley shipments of November were 35,000 qr. from North America; 2,038,000 qr. from Russia; 469,000 qr. from Roumania and Bulgaria; 50,000 qr. from India and Persia; and 5,000 qr. from Spain. The last item is an interesting revival in a very old source of barley supply. There are now 475,000 qr. on passage altogether. This is not a large aggregate, though, as we have seen, the Russian contribution is large.

Oats.—Canada sent off in November 25,000 qr. only. Our market is paying a full guinea for 320 lb., and could take an indefinitely increased supply. The "Canada Year Book," recently published, shows that the average price on the farm for 1910 was only 12*s.* 7*d.* per qr., so that an excellent margin for trade should exist. South America shipped 165,000 qr., mainly very poor stuff of thick husk and about 288 lb. in natural weight. These oats are being sold at our ports for 17*s.* to 18*s.*, the weight being made up to 304 lb.

Russia has shipped 845,000 qr. and Europe S.E. 326,000 qr.; the Roumanian and Bulgarian on arrival are sold for 17*s.* per 304 lb., the Russian often being held for 18s. The supply of heavy oats, 320 to 336 lb., being in effect confined to farmers' deliveries, the month's average has shown a shilling rise even where markets have been continuously reported as dull. The quantity on passage is about 250,000 qr., and includes far too great a proportion of the poorest qualities.

Maize.—The ruling quotation has been 5*s.* 8*d.* per cental (27*s.* 3*d.* per 480 lb.) for American new crop delivered for cash at any British western port (5*s.* 9*d.* at an east coast port) during any month of 1912 from January to May. This price has dominated all immediate spot transactions, for which an average quotation of 30*s.* per qr. irrespective of shape or colour, round or flat, white or yellow, would be very little out. The fine small round maize, called Cinquantina, suits birds for which other sorts are too large. It commands in consequence 3*s.* to 4*s.* per qr. (in retail 6*d.* per bushel) more than the other kinds.

Maize shipments during November were 121,000 qr. from the United States; 131,000 qr. from Russia; and 276,000 qr. from Europe S.E. The quantity on passage on the 30th was 330,000 qr., against 930,000 qr. a year previously. The United Kingdom imports since September 1st have been much below the average.

Oilseeds.—Reference has already been made to the important reduction in linseed quotations. On the 30th Argentina was offering to ship in January at 53*s.* per 416 lb., and India was willing to ship in April at the same price per 410 lb. November shipments, 77,000 qr. from India and 126,000 qr. from Argentina, were much below the average, but represent, of course, old crop consignments only. Egyptian new crop cottonseed is now on our markets, but £8 10*s.* per ton is a price not very attractive to buyers.

Various.—Beet-sugar has fluctuated between 16*s.* and 17*s.* per cwt. The yield on the continent this autumn is much below that of last year. Rice has lost 1*d.* to 2*d.* per cwt. in spot value, but is still comparatively dear. Owing to the fine quality of this year's home growth of beans, peas, tares, and rye, prices have been stiffly supported despite slow markets. Russian buckwheat has declined 4*s.* on the month, 26*s.* per 416 lb. being now accepted. Haricots remain very dear. The writer noticed Indian chick peas offered on the 29th at 28*s.* 6*d.* per qr., or 1*s.* 6*d.* under the price previously given, but on inquiry found that the quarter was 480 lb. only, whereas the natural weight is usually 504 lb., and sales have hitherto nearly always been made by a quarter of that weight; 28*s.* 6*d.* per 480 lb. is practically 30*s.* per 504 lb.

THE LIVE AND DEAD MEAT TRADE IN NOVEMBER.

A. T. MATTHEWS.

Fat Cattle.—The general condition of the cattle on offer during November can scarcely be said to have improved, though, here and there, a few stall-fed animals began to appear. The supplies of half-meated bullocks have formed the leading feature at most markets, and the unusual difference of 1*s.* per stone between first and second quality has told its own tale. Trade, however, has maintained a healthy tone, prices have gradually hardened, and are now about 2*d.* per stone better than those of last year at this time. The fact that

at Ipswich, where there have been fair supplies of ripe Shorthorns from the stalls, butchers have been willing to give 9*s.* 6*d.*, and even 10*s.* per stone for weeks together, while the top price at other markets has been 8*s.* 9*d.*, is very significant, seeming to show that even costly artificial feeding has been well repaid. The following are the averages in twenty English markets for the first four weeks in November:—Shorthorns, 8*s.* 5*d.*, 7*s.* 5*d.*, and 6*s.* 3*d.*, against 8*s.* 3*d.*, 7*s.* 3¾*d.*, and 6*s* 2¼*d.* in October; Herefords, 8*s.* 7½*d.* and 7*s.* 8*d.*, against 8*s.* 5½*d.* and 7*s.* 9¼*d.*; Devons, 8*s.* 7½*d.* and 7*s.* 7½*d.*, against 8*s.* 5¼*d.* and 7*s.* 5½*d.*; Welsh Runts, 8*s.* 3*d.* and 7*s.* 6*d.*, against 8*s.* 1¾*d.* and 7*s.* 3¼*d.*; and Polled Scots, 8*s.* 7*d.* and 7*s.* 9¼*d.*, against 8*s.* 5¼*d.* and 7*s.* 8½*d.* per stone. Thus it may be said that English beef has advanced 2d. per stone during the month. Trade was very good in Scotland, and prices a little higher than in England, Shorthorns fetching frequently 40*s.* per cwt., and Scots up to 43*s.* 4*d.* by live weight.

Veal Calves.—The fat calf trade remained in a rather lifeless condition, veal being in only small demand. Although different markets have varied from 7¼*d.* to 9*d.* per lb. for first quality, yet the averages have worked out every week at 8*d.* and 7*d.* in all British markets.

Fat Sheep.—The chief feature in the fat sheep trade was the large number of tegs coming out three months before their proper time, forced sales having to be made through the terrible scarcity of winter keep. Islington market has been full of young sheep that would, in ordinary seasons, be kept till March. These have made from 35*s.* to 42*s.* each, many of them being from Norfolk and some from Oxfordshire. Hampshire tegs were also fairly supplied, but this is their normal season. The trade was dull and dragging, yet prices, though very low, were better than in October by ¼*d.* per lb. The average in English markets for the month was 7¾*d.*, 6¾*d.*, and 5¼*d.* for the three classes of Downs, and 7¼*d.*, 6¼*d.*, and 5*d.* per lb. for Longwools.

In a long journey through a turnip and sheep district the writer only saw two or three fields of swedes worth the cost of pitting, and it seems plain that the weight of mutton that can be produced in southern England this winter must be the smallest for many years. The prospect is therefore a gloomy one for producers and consumers of English mutton. Prices must, to all appearance, be very high in the spring. Next season's clip of wool must also be affected by the present premature sales.

Fat Pigs.—The value of bacon pigs has continued its downward course, giving way, on the average of thirty British markets, from ½*d.* to 1*d.* per stone per week. Prime small pigs averaged 6*s.* 2¼*d.* and larger weights 5*s.* 7*d.* per stone. Last year at this time the average stood at 7*s.* 4*d.* and 6*s.* 9*d.*

Carcass Beef—British.—Home-grown beef has just about followed the course of the live-stock markets with a quiet trade and little fluctuation. Scotch short sides in Smithfield Market fetched an average of 7¼*d.* and 7*d.* for first and second quality, long sides 6⅜*d.* and 6⅛*d.*, and English 5¾*d.* to 6*d.* per lb.

Port-Killed Beef.—American beef slaughtered at Deptford was in moderate supply, and sold freely at an average for the month of 6*d.* per lb. for first and 5⅝*d.* for second quality. The supply of "Rancher" beef was not large, and the best of it made about 5*d.* per lb.

Chilled Beef.—There was scarcely any States chilled on the market, but there were the usual heavy supplies of Argentine. The colder weather helped the trade, and there was a slight average advance established in hindquarters, and a much greater one in forequarters, which last stood, during October, at an absurdly low level. Hinds in November made $4\frac{1}{8}d.$ per lb. for the best, and $3\frac{5}{8}d.$ for second quality, while fores averaged $2\frac{1}{2}d.$ and $2\frac{1}{4}d.$, which was nearly double the October prices.

Frozen Beef.—This class of beef was again much neglected, as it usually is when chilled is at its present low figure. Hindquarters have averaged $3d.$ to $3\frac{1}{2}d.$ per lb., according to quality, but forequarters have fetched nearly as much as chilled.

Carcass Mutton—Fresh-Killed.—Scotch mutton sold during the first three weeks at $6\frac{1}{2}d.$ to $7d.$ per lb., but an advance of fully $\frac{1}{4}d.$ then took place, and a good many choice Half-breds fetched $7\frac{1}{2}d.$ English was very slow, and the best West Country tegs never exceeded $6\frac{1}{4}d.$ per lb. Dutch sold relatively well, and made $5\frac{1}{2}d.$ to $6d.$ per lb.

Frozen Mutton and Lamb.—The best "Canterbury" mutton sold at $4\frac{1}{4}d.$ to $3\frac{3}{4}d.$ per lb., but this does not include ewe carcasses. Argentine and Australian were about $\frac{1}{2}d.$ per lb. below New Zealand. New Zealand lamb was cheaper on the month, fetching $5\frac{1}{4}d.$ as the top price. Some new season Argentine made $5d.$ per lb.

Veal.—The trade was irregular. Prime English was extremely scarce, and sometimes could not be quoted. Second quality made from $6\frac{1}{2}d.$ to $7\frac{1}{2}d.$ per lb., according to supply.

Pork.—Supplies were large, both of English and Dutch, and the former averaged $6\frac{1}{4}d.$ for prime small and $5\frac{3}{4}d.$ for larger pigs. Dutch fetched about $\frac{1}{4}d.$ per lb. less money.

THE PROVISION TRADE IN NOVEMBER.

HEDLEY STEVENS.

Bacon.—Following the general reduction in prices during the month of October, values were advanced several shillings per cwt. early in November, which again checked the demand, and all markets suffered. A slump took place in some descriptions, especially in the case of long sides, best selections of which were offered at the end of the month at from 48*s.* to 52*s.* These are lower prices than for some years past. It is considered likely that these low figures will last for a few weeks at least, as the killings in Denmark for the second half of the month were roughly 100,000 pigs, which means that about 200,000 long sides will be placed on the English markets for sale during, say, two weeks of December. The killings in Ireland were large, resulting in Irish bacon being very cheap.

The shipments from America to this country were also heavier, and as the American hogs are still being marketed freely, the immediate outlook is for a continued lower range of prices on the other side of the Atlantic. The value of hogs at Chicago during the month ranged from $5.40 to $6.60, against $6.60 to $8.50 during the same period of last year, and $7.25 to $8.45 two years ago. Meanwhile the demand for American and Canadian bacon on the British markets was again

very small; in fact, some cuts of American were practically unsaleable, so causing an accumulation of stock, this tending still further to keep prices down, probably until the end of the year.

The English curers still report that they are able to obtain all the pigs they want, and as breeders continue to be anxious to reduce their holdings, the view is generally expressed that we shall see much higher prices around April next, when in most pig-rearing countries the effect of killing off the young stock will be seriously felt.

Cheese.—The demand throughout the month was not large, and prices showed little change, although perhaps on the whole they were a little firmer. Best Canadians made 69*s.* to 71*s.* Advices from Canada confirmed the shortage in the make in that country, and cables demanded from 68*s.* to 70*s.* for best "fall-makes," but there was not much business transacted, importers being afraid to operate at such prices, with each of the steamers from New Zealand bringing moderate shipments from that country. The quality of this latter cheese is reported to be very satisfactory for so early in the season, and prices ranged from 68*s.* to 69*s.*

The present high prices of Canadian and New Zealand—in the case of the former say 15*s.*, and the latter 12*s.* per cwt. over those current at the same time last year—is bound to curtail the consumption of cheese during the winter, but it is maintained by those best able to judge that with the big shortage in the home make, even with the decreased consumption, all the cheese will be wanted before the new season opens.

At the end of the month the estimated stock of Canadian cheese at the three principal distributing centres (London, Liverpool, and Bristol) was 314,000 cheese, against 428,000 at the same time last year, and 419,000 two years ago.

English cheese was in fair demand at advanced prices, but the extremely high prices prevented any freedom in business. On account of the great shortage of stocks, holders were independent sellers, even at the abnormal prices current.

Butter.—The reduction in prices reported during the previous month did not continue, and with the stored stocks of the merchants much decreased, as well as a better consumptive demand, prices again advanced several shillings. The arrivals from Australia and New Zealand were more free by the end of the month, but found ready buyers at full prices, especially the best grades. Although the Australian season was backward, the shipments to date are about equal to those for the same period of last year. Arrivals from Denmark were below average, but it is expected that they will soon increase.

Canada has now practically stopped shipping, and there is very little coming from America, as the prices in both countries are out of competition with those ruling here for Australian and New Zealand. In America equal to 143*s.* c.i.f. is being made freely for creameries.

Eggs.—Eggs retained their high range of prices, which curtailed the consumption. English were again very scarce.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of November, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	8 6	7 10	41 2	37 2
Herefords	8 7	7 9	—	—
Shorthorns	8 5	7 5	39 10	36 3
Devons	8 8	7 9	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8	7¼	8½	7
Sheep:—				
Downs	7¾	6¾	—	—
Longwools	7¼	6¼	—	—
Cheviots	8	7¼	7¾	6¾
Blackfaced	7½	6½	7	6¼
Cross-breds	7¾	6¾	8	6¾
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	6 2	5 8	5 11	5 4
Porkers	7 0	6 6	6 6	5 10
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 6	18 3	23 13	18 9
,, —Calvers... ...	21 4	17 17	19 5	17 12
Other Breeds—In Milk ...	18 14	15 17	19 19	16 6
,, —Calvers ...	14 5	12 2	19 11	16 6
Calves for Rearing	2 1	1 10	2 13	1 14
Store Cattle:—				
Shorthorns—Yearlings ...	9 6	7 15	10 9	8 17
,, —Two-year-olds...	12 17	11 2	14 7	12 8
,, —Three-year-olds	16 15	14 17	16 16	—
Polled Scots—Two-year-olds	—	—	14 15	13 6
Herefords— ,,	14 11	13 2	—	—
Devons— ,,	12 19	11 3	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	30 3	23 11	—	—
Scotch Cross-breds ...	—	—	26 10	20 7
Store Pigs:—				
8 to 10 weeks old	13 6	9 6	15 4	11 6
12 to 16 weeks old	23 1	16 7	—	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—							
English	1st	56 0	50 6	56 6	49 6	57 0*	58 0*
	2nd	50 6	46 0	53 6	46 0	50 6*	51 6*
Cow and Bull ...	1st	45 6	43 6	45 6	43 6	46 0	46 0
	2nd	41 0	37 6	40 6	38 6	38 0	40 6
U.S.A. and Canadian :—							
Port Killed ...	1st	53 6	51 6	56 0	—	—	51 6
	2nd	46 6	46 0	52 6	46 6	—	49 0
Argentine Frozen—							
Hind Quarters...	1st	32 6	31 6	33 0	31 6	32 0	31 6
Fore ,, ...	1st	23 0	23 0	23 0	22 0	21 6	21 6
Argentine Chilled—							
Hind Quarters...	1st	37 6	36 6	38 6	36 6	39 0	38 0
Fore ,, ...	1st	24 6	23 6	24 0	23 6	24 6	25 6
Australian Frozen—							
Hind Quarters...	1st	32 6	31 6	33 0	31 6	—	30 0
Fore ,, ...	1st	23 6	20 0	23 0	20 0	—	20 0
VEAL :—							
British	1st	61 6	71 6	70 0	70 0	—	66 6
	2nd	52 6	65 6	63 6	65 6	—	65 6
Foreign	1st	—	—	71 6	—	75 0	—
MUTTON :—							
Scotch	1st	63 0	65 0	66 0	64 6	60 6	67 6
	2nd	—	59 6	61 6	61 0	52 0	48 6
English	1st	58 6	60 0	59 0	61 0	—	—
	2nd	—	54 6	52 6	56 0	—	—
Argentine Frozen ...	1st	33 6	33 0	34 0	33 0	32 6	33 0
Australian ,, ...	1st	31 6	31 0	31 6	31 0	—	30 6
New Zealand ,, ...	1st	—	—	39 0	—	—	—
LAMB :—							
British	1st	—	—	—	—	—	—
	2nd	—	—	—	—	—	—
New Zealand ...	1st	51 6	46 0	49 6	46 6	—	46 6
Australian	1st	43 6	40 0	44 6	40 0	—	39 6
Argentine	1st	41 6	38 6	45 0	38 6	—	39 6
PORK :—							
British	1st	63 0	64 0	58 0	63 0	55 6	54 6
	2nd	56 6	59 6	53 0	58 0	46 0	50 0
Foreign	1st	—	—	55 0	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1909, 1910 and 1911.

Weeks ended (*in* 1911).	WHEAT.						BARLEY.						OATS.					
	1909.		1910.		1911.		1909.		1910.		1911.		1909.		1910.		1911.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 7 ...	32	9	33	6	30	5	26	11	24	11	23	11	17	5	17	2	17	0
,, 14 ...	32	8	33	8	30	8	27	1	24	11	23	10	17	5	17	7	17	2
,, 21 ...	33	2	33	9	30	11	27	3	24	11	24	4	17	8	17	6	17	4
,, 28 ...	33	0	33	6	30	11	27	6	25	0	24	5	17	9	17	4	17	3
Feb. 4 ...	33	4	33	7	30	9	27	7	24	10	24	5	17	10	17	7	17	5
,, 11 ...	33	8	33	4	30	5	27	8	24	9	24	6	17	11	17	11	17	5
,, 18 ...	34	1	33	0	30	3	27	11	24	6	24	7	18	0	18	0	17	6
,, 25 ...	34	5	32	7	30	2	28	0	24	2	24	9	18	0	17	10	17	7
Mar. 4 ...	34	10	32	7	30	0	27	11	24	6	25	0	18	2	18	1	17	5
,, 11 ...	35	8	32	6	30	1	28	4	24	1	25	0	18	2	18	0	17	5
,, 18 ...	35	9	32	6	30	1	28	0	23	6	24	11	18	5	18	0	17	6
,, 25 ...	36	0	32	9	30	2	28	0	23	7	25	0	18	6	17	11	17	5
Apl. 1 ...	36	5	33	0	30	3	27	10	23	8	24	11	18	8	18	0	17	5
,, 8 ...	37	4	33	6	30	4	28	0	23	1	24	7	18	10	17	11	17	7
,, 15 ...	38	7	33	7	30	3	27	8	23	5	25	2	19	2	18	3	18	3
,, 22 ...	41	4	33	7	30	4	28	2	23	0	25	5	19	9	18	3	17	10
,, 29 ...	42	5	33	0	30	11	27	10	22	10	25	5	20	0	18	3	18	3
May 6 ...	40	9	32	6	31	4	27	7	22	7	25	7	20	3	18	2	18	6
,, 13 ...	41	6	32	1	31	8	27	3	22	0	25	1	20	6	18	1	19	0
,, 20 ...	42	8	31	10	32	6	27	0	21	8	25	4	20	11	17	8	19	2
,, 27 ...	42	6	31	3	32	8	26	3	21	4	25	0	21	0	17	10	19	5
June 3 ...	43	1	30	2	32	5	25	7	21	8	24	10	21	3	17	10	19	5
,, 10 ...	42	11	29	1	32	4	26	10	20	9	25	7	21	4	17	10	19	7
,, 17 ...	42	7	29	0	32	3	26	10	18	11	23	11	21	6	18	0	19	8
,, 24 ...	42	8	29	4	31	11	27	2	20	1	23	9	21	7	17	9	19	10
July 1 ...	42	9	29	9	31	10	27	2	19	11	24	5	21	9	17	7	19	9
,, 8 ...	43	0	30	4	32	1	26	4	19	5	25	10	21	8	17	4	19	9
,, 15 ...	43	3	31	1	32	3	26	10	21	3	25	10	21	9	17	7	19	11
,, 22 ...	44	0	31	11	32	5	27	4	19	9	24	3	22	5	17	5	19	5
,, 29 ...	43	5	33	5	32	5	24	6	20	10	23	8	22	2	18	1	19	7
Aug. 5 ...	44	9	33	9	32	0	27	4	20	5	24	4	22	11	18	3	18	2
,, 12 ...	44	9	33	5	31	6	24	9	20	4	26	9	21	8	18	0	18	0
,, 19 ...	41	6	32	11	31	6	23	11	20	11	27	8	19	8	17	11	17	10
,, 26 ...	38	5	32	7	31	8	24	7	20	10	28	10	19	4	17	2	18	0
Sept. 2 ...	37	2	32	2	31	7	26	3	22	10	28	4	19	6	17	2	18	3
,, 9 ...	34	11	31	11	31	10	26	1	23	3	28	4	18	5	17	2	18	1
,, 16 ...	33	6	30	11	32	0	26	5	24	3	29	0	17	9	16	6	18	5
,, 23 ...	32	9	30	2	32	4	26	8	24	2	29	11	17	7	16	3	18	9
,, 30 ...	32	2	30	1	32	6	26	9	24	4	30	5	17	2	16	4	19	1
Oct. 7 ...	31	8	30	1	32	7	26	9	24	7	30	9	17	0	16	3	19	5
,, 14 ...	31	4	30	2	32	9	27	0	25	1	31	0	17	0	16	2	19	10
,, 21 ...	31	8	30	4	32	9	27	7	25	3	31	5	16	11	16	1	19	11
,, 28 ...	31	10	30	4	33	1	27	9	25	4	31	7	17	0	16	2	20	6
Nov. 4 ...	32	5	30	4	33	4	27	9	25	6	31	10	17	0	16	2	20	8
,, 11 ...	32	5	29	11	33	4	27	7	25	4	32	7	17	1	15	11	20	11
,, 18 ...	32	7	29	8	33	1	27	0	25	1	32	10	17	4	16	1	21	0
,, 25 ...	33	0	29	11	33	0	26	8	24	10	33	5	17	3	16	4	20	10
Dec. 2 ...	33	3	30	6	32	10	26	1	24	7	33	10	17	4	16	7	20	11
,, 9 ...	33	3	30	9	32	9	25	7	24	3	34	0	17	3	16	9	20	9
,, 16 ...	33	2	30	7			25	3	23	9			17	4	16	10		
,, 23 ...	33	1	30	7			25	2	23	10			17	4	16	9		
,, 30 ...	33	3	30	5			25	1	23	9			17	4	16	9		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

		Wheat.		Barley.		Oats.	
		1910.	1911.	1910.	1911.	1910.	1911.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
France :	October	46 4	43 0	25 7	27 7	21 0	21 11
	November	46 2	43 3	25 8	27 11	21 0	22 2
Paris :	October	48 10	43 7	25 5	26 10	21 6	22 8
	November	48 1	43 9	26 0	27 3	21 3	22 11
Belgium :	September	33 5	34 2	21 10	26 7	19 9	22 3
	October	33 7	34 1	22 6	27 7	18 11	22 4
Germany :	September	41 0	43 4	25 4	33 4	20 2	24 4
	October	40 11	43 3	26 8	34 4	20 9	25 0
Berlin :	September	43 6	44 2	—	—	20 9	25 4
	October	43 1	43 10	—	—	20 3	25 7
Breslau :	September	38 3	40 10	25 10* / 22 11†	30 8* / 24 9†	20 3	23 2
	October	38 5	40 4	25 9* / 22 11†	30 10* / 25 1†	20 7	23 7

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique* ; the Belgian quotations are the official monthly averages published in the *Moniteur Belge* ; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of November, 1910 and 1911.

	Wheat.		Barley.		Oats.	
	1910.	1911.	1910.	1911.	1910.	1911.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London	31 2	34 4	25 5	34 7	17 4	21 8
Norwich	30 6	32 11	24 2	33 3	16 2	21 0
Peterborough	29 5	32 8	25 11	32 2	15 8	20 11
Lincoln...	29 5	33 2	25 3	32 5	16 4	21 6
Doncaster	29 8	32 11	23 7	31 9	15 11	21 1
Salisbury	29 9	32 3	23 3	32 3	16 1	20 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of November, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ..	16 0	15 0	—	—	17 0	15 3	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	129 0	125 0	130 6	128 0	130 6	126 6	130 0	128 0
,, Factory	117 6	111 6	116 0	111 6	118 6	112 6	—	—
Danish ..	—	—	137 6	135 6	137 0	134 6	133 0	—
French ...	—	—	—	—	141 0	138 6	—	—
Russian ...	121 6	116 6	123 0	118 0	122 6	119 0	122 6	118 0
Canadian ...	126 6	122 6	124 0	121 6	121 0	120 0	124 0	—
Australian ...	134 0	130 0	132 6	130 0	132 6	128 0	131 6	129 6
CHEESE :—								
British—								
Cheddar ...	88 0	83 0	87 0	83 0	93 0	85 0	75 6	73 6
			120 lb.	120 lb.	120 lb.	120 lb.	120 lb.	120 lb.
Cheshire ...	—	—	85 6	79 0	95 0	82 6	92 0	88 0
			per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Canadian ...	70 0	68 6	70 0	68 0	71 0	69 6	70 0	—
BACON :—								
Irish	59 6	56 0	58 0	54 0	61 0	58 0	61 0	60 6
Canadian ...	56 6	54 0	54 0	52 0	56 6	53 6	56 0	54 0
HAMS :—								
Cumberland .	—	—	—	—	110 6	100 6	—	—
Irish	—	—	—	—	112 0	106 0	80 0	74 0
American (long cut)	61 0	57 0	61 6	56 6	65 0	61 0	58 6	57 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	19 2	16 3	—	—	20 2	18 1	—	—
Irish	16 5	15 7	15 10	14 6	17 0	15 0	16 10	15 1
Danish ...	—	—	15 11	14 10	17 10	16 5	16 11	16 5
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	91 0	81 0	65 0	60 0	83 0	75 0	—	—
Langworthy ..	80 0	70 0	85 0	75 0	86 0	80 0	—	—
Up-to-Date ...	80 6	72 6	56 6	53 6	85 6	78 0	60 0	55 0
HAY :—								
Clover ...	110 0	100 0	118 0	91 6	122 0	100 0	85 0	80 0
Meadow ...	105 0	95 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1910.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(*From the Returns of the Board of Agriculture and Fisheries.*)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1911.	1910.	1911.	1910.
Swine-Fever:—				
Outbreaks	151	146	2,232	1,360
Swine Slaughtered as diseased or exposed to infection ...	2,215	1,437	27,030	12,624
Anthrax:—				
Outbreaks*	86	112	809	1,318
Animals attacked	98	135	990	1,567
Foot-and-Mouth Disease:—				
Outbreaks	—	—	18	2
Animals attacked	—	—	467	15
Glanders (including Farcy):—				
Outbreaks	15	13	192	330
Animals attacked	44	33	463	956
Sheep-Scab:—				
Outbreaks	38	38	354	399

* For 1910 the figures show the outbreaks reported, but for 1911 the outbreaks confirmed.

IRELAND.

(*From the Returns of the Department of Agriculture and Technical Instruction for Ireland.*)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1911.	1910.	1911.	1910.
Swine-Fever:—				
Outbreaks	30	8	143	86
Swine Slaughtered as diseased or exposed to infection ...	421	189	2,344	1,967
Anthrax:—				
Outbreaks	2	—	9	7
Animals attacked	2	2	14	12
Glanders (including Farcy):—				
Outbreaks	—	—	2	1
Animals attacked	—	—	3	2
Sheep-Scab:—				
Outbreaks	23	23	304	405

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